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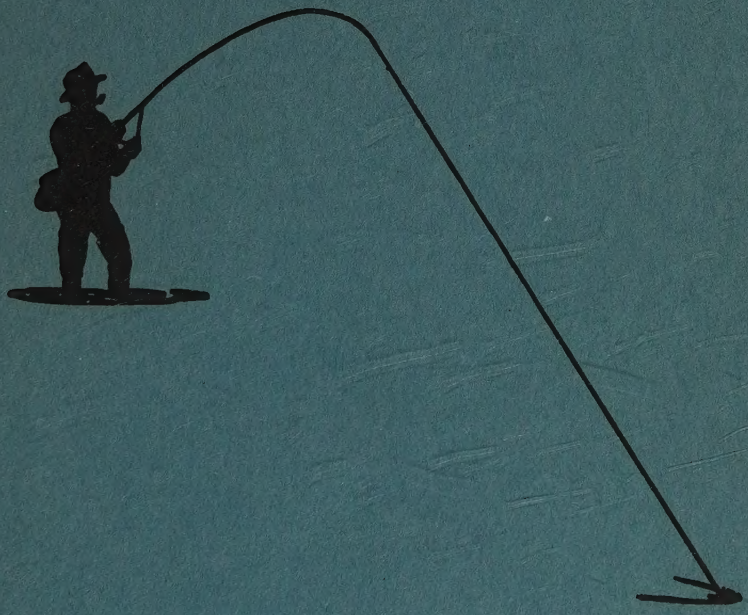
Sport Fishery Abstracts



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Sport Fishery Abstracts

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes. The last number of each volume contains a list of publications screened for appropriate material.

Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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Prepared in the Div. of Fishery Research
Paul S. Handwerk, Editor
Angela S. Sutt, Asst. Editor

7121. Merrell, Theodore R., Jr. (Bur. Comm. Fish. Biol. Lab., U. S. Fish and Wildlife Service, Auke Bay, Alaska). 1964. ECOLOGICAL STUDIES OF SOCKEYE SALMON AND RELATED LIMNOLOGICAL AND CLIMATOLOGICAL INVESTIGATIONS, BROOKS LAKE, ALASKA, 1957. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 456, 66 pp.

Ecological studies on the fresh-water phases of the life history of sockeye salmon and studies on related limnology and climatology were made at Brooks Lake, Alaska, in 1957.

Data are presented and interpreted on adult sockeye salmon spawning distribution and behavior, age, sex, length, fecundity, and bear predation; on juvenile sockeye salmon ages, food, growth, migration from the lake, relative abundance, and distribution in the lake; and on climatological and limnological factors that may influence sockeye salmon behavior and abundance. (Auth. Abst.)

7122. Zimmer, Paul D., and John H. Broughton (Bur. Comm. Fish. Columbia Fisheries Program Office, U. S. Fish and Wildlife Service, Portland, Oregon). 1964. ANNUAL FISH PASSAGE REPORT - ROCK ISLAND DAM, COLUMBIA RIVER, WASHINGTON, 1962. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 467, 26 pp.

Fish using the three fishways at Rock Island Dam in 1962 were counted from May 1 to October 27. Total number of salmon and steelhead trout exceeded the 1961 count by approximately 12,300 fish.

The 1962 count of 34,154 chinook salmon was well above the mean of 16,178 for the 29-year period 1933-61 and exceeded the 1961 count by approximately 1,100 fish. The 29,253 sockeye salmon counted was approximately 10,000 more than recorded in 1961 and spproximately 57 percent of the 29-year mean of 51,920. The 737 coho salmon were approximately 500 more than recorded in 1947, year of previous high count, and greatly exceeded the 50 fish in 1961. The number of steelhead trout passing Rock Island Dam in 1962 was the highest recorded since counting began in 1933 and was more than twice the 29-year mean of 3, 189. Fish other than salmon and steelhead trout passing through the fishways at Rock Island Dam in 1962 numbered 164, 574 and exceeded the count of salmon and steelhead trout by approximately 93,000 fish.

Of 71, 735 salmon and steelhead trout observed at Rock Island Dam in 1962, approximately 0.5 percent had some visible evidence of injury about the head or body. (Authors' Abst.)

7123. Jenkins, Robert M. (Bur. Sport Fish. and Wildl., Fayetteville, Arkansas). 1964. RESERVOIR FISHERY RESEARCH STRATEGY AND TACTICS. U. S. Fish and Wildlife Service, Circular 196, 12 pp.

Large public reservoirs (over 500 acres) now comprise about a third of the United States inland fishing water, and attract about a fourth of all sport fishing. Angler days on reservoirs will almost double by 1976, and yields on existing ones must be increased 30 percent to maintain present catch rates. Known management techniques are inadequate to meet projected requirements, and new biological knowledge is needed.

Research problems requiring attention include measurements of the effects, on fish production, of primary productivity, rate of water exchange, and water level fluctuations and withdrawal at various depths. Fertile fields of inquiry are the reproduction and early life history of principal fishes, species competition, and analyses of behavior. Intensive study of localized populations, supplemented by extensive examination of the dynamics of total reservoir fish populations, should provide new ecosystem concepts.

How important is allochthonous (washed-in) watershed material in fish productivity? Can we develop sound methods of attacking problems by changing some one element, removing or adding an element or species, or modifying an environmental factor?

The success of such instrument and method innovations as automatic collection of water-quality and plankton data, the two-man submarine, SCUBA diving, echo sounders, trawls, electrofishing gear, fluorescent-dye current measurements, and mass tagging techniques would greatly enhance our ability to describe phenomena. Progress will depend in large measure on the imagination, acuteness of observations, clarity of thought, and synthesizing ability of every reservoir fishery scientist. (Auth. Abst.)

7124. Eberly, William R. (Manchester College, North Manchester, Indiana). 1964. FURTHER STUDIES ON THE METALIMNETIC OXYGEN MAXIMUM, WITH SPECIAL REFERENCE TO ITS OCCURRENCE THROUGHOUT THE WORLD. Investigations of Indiana Lakes & Streams, Vol. VI, No. 3, pp. 103-139.

Lake water can be saturated with oxygen largely through physical means during the period of spring circulation. At the hypothetical homothermous temperature of 4° oxygen saturation occurs at 12.7 mg/L (at sea level). It is suggested that the oxygen content of the metalimnion should exceed this value before the term "plus-heterograde" is applicable to the resulting oxygen curve. A lake that exhibits a plus-heterograde oxygen curve throughout most of the period of summer stagnation until the beginning of fall circulation is called a plus-heterograde lake type.

A list of 54 lakes from various areas of the world has been compiled, from which 98 separate instances of metalimnetic oxygen maxima (in some cases representing several years) have been observed. Most of these lakes occur in the glacial region of Wisconsin and Indiana, the Alpine mountains of Switzerland and Austria, and the mountain regions of Japan. Morphometry (both area and relative depth) appears to be a significant factor in the development of the metalimnetic oxygen

maximum in the U. S. lakes. Variations in the oxygen maximum could be related to area in the Japanese lakes but not to relative depth. No positive correlation between any morphometric character and the oxygen maximum seemed to exist in the Alpine lakes.

Four types of oxygen maxima are described. The pseudo-metalimnetic oxygen maximum develops temporarily early in the summer under a high secondary thermocline in very small, well-protected lakes. A temporary sub-climax oxygen maximum, with highest values in early summer, occurs in the deep layers of the metalimnia of lakes with high transparency. Permanent climax oxygen maxima are characteristic throughout most of the summer and generally reach highest oxygen values just prior to the beginning of fall circulation. Two subtypes, Diatom maxima and Oscillatoria maxima, are differentiated on the basis of the dominent phytoplankton organisms present.

Primary production in Myers and McLish lakes, two Oscillatoria-lakes in northern Indiana, is discussed. Photosynthetic efficiency in the metalimnion at the level of maximum oxygen production is approximately 0.8% in McLish Lake and 1.7% in Myers Lake. Overall production in McLish is about 0.7 g C/m^2/day and in Myers during the time the extensive plankton bloom was present about 1.7 g C/m^2/day (late summer rates). Very little bacterial and/or nannoplankton activity seems to be evident at the levels of maximum Oscillatoria population. (Auth. Abst.)

7125. Skidmore, J. F. (Dept. Zool., Australian National Univ., Canberra, Australia). 1964. TOXICITY OF ZINC COMPOUNDS TO AQUATIC ANIMALS, WITH SPECIAL REFERENCE TO FISH. The Quarterly Review of Biology, Vol. 39, No. 3, pp. 227-248.

The toxicity of zinc compounds to aquatic animals is modified by several environmental factors, particularly the hardness of the dilution water, the dissolved oxygen concentration, and temperature. The resistance of aquatic animals to zinc poisoning varies with species. It is modified by acclimatization, and possibly by age. Survival time is inversely proportional to concentration of zinc. For these reasons concentrations reported as lethal have varied widely.

The mode of toxic action of zinc is uncertain. At acutely toxic concentrations it probably kills fish by destroying gill tissues. At chronically toxic levels it may induce stress resulting in death. The action of zinc undoubtedly differs at different concentrations, it varies with life history, and it is non-specific. (Auth. Abst.)

7126. Bainbridge, Richard (The Zoological Lab., Univ. of Cambridge, Cambridge, Endland). 1962. TRAINING, SPEED AND STAMINA IN TROUT. The Journal of Experimental Biology, Vol. 39, No. 4, pp. 537-555.

A number of trout (Salmo irideus) were kept continuously swimming for a period of 12 months in experimental tanks in which the water was made to rotate at a mean speed of 25 cm/sec.

These fish become available for study in the 'Fish Wheel' and measurements were made of the maximum speed they sustained for periods of swimming of different duration.

For bursts of swimming of up to 20 sec. duration the mean accomplishments of these fish were identical with those of the unexercised trout studied previously.

Considerable variability was found among the specimens tested and the best of the presently exercised fish were appreciably better than the best of the previously unexercised ones. The biggest improvement was 36% at the 10 sec. period of swimming; the mean percentage improvement for all periods was 11%.

Some specimens were found to be better at swimming for short periods and others at swimming for longer periods.

In the absence of comparable figures for the earlier fish, the measurements of cruising speeds sustained for periods up to 1-1/2 hr. were compared with other figures in the literature and found to be about half some of those for wild fish.

The implications of the results are considered and two interpretations stressed. First, it is assumed that there is a real identity of accomplishment for short periods of swimming, values being determined perhaps solely by gross mass of muscle; while for longer periods of swimming differences dependent upon respiratory rate, etc., may well occur. Secondly, for such longer periods the discrepancies reported here may well be accounted for by differing degrees of stimulus and behavioral response under varied experimental conditions.

7127. Roots, Betty I. (Dept. Biol., Royal Free Hospital School of Medicine, 8 Hunter St., London, W. C. 1, England), and C. Ladd Prosser. 1962. TEMPERATURE ACCLIMATION AND THE NERVOUS SYSTEM IN FISH. The Journal of Experimental Biology, Vol. 39, No. 4, pp. 617-628.

The cold-blocking temperature of a simple reflex in goldfish (Carassius auratus) and bluegills (Lepomis macrochirus) was 10°, 5°, and 1° C, respectively, for fish acclimated to 35°, 25°, and 15° C. The response of 5° C fish was not blocked at 1° C.

Similar results were obtained with goldfish in which the spinal cord had been cut immediately posterior to the medulla.

Conditioned inhibition of respiration in goldfish acclimatized to 30°, 25°, 15°, and 5° C was blocked at 20°, 15°, 10°, and 1° C, respectively.

A conditioned avoidance response of goldfish acclimated to 25° C was blocked at 15° C.

The cruising speed of green sunfish (Lepomis cyanellus) is related to the ambient temperature, and the upper and lower temperatures at which they do not swim are related to their thermal history.

Peripheral nerves of bluegills and green sunfish acclimated to 25° C continued to conduct

impulses at temperatures below 5° C.

It is concluded that the site of cold-block is in the central nervous system. (Auth. Summ.)

7128. Foye, Robert E. (Dept. of Inland Fisheries and Game, Augusta, Maine). 1964. CHEMICAL RECLAMATION OF FORTY-EIGHT PONDS IN MAINE. Progressive Fish-Culturist, Vol. 26, No. 4, pp. 181-185.

Follow-up studies were made in 1960 and 1961 at 48 ponds chemically reclaimed in Maine during 1949-59. Tributaries and marshy areas, stratification, alkalinity, and toxicants were evaluated as possible causes of incomplete kills of undesirable species. Competitive fishes were completely removed in 24 of the 48 ponds. Kills were incomplete with several products and concentrations. No product (except Fish Tox) or concentration was more efficient than another in effecting complete kills. Thirteen species suffered complete kills each time they occurred; incomplete kills occurred one or more times among 17 other species. Fishes with the greatest number of incomplete kills were largely stream-dwelling species. The major factor influencing our ability to remove completely the competitive fishes in some lakes and ponds is apparently our inability to treat successfully the tributaries and adjacent marshes. (Auth.)

7129. Poluhowich, John J. (237 Dover Street, Bridgeport, Connecticut). 1964. AN UNDERWATER CAMERA HOUSING FOR SHALLOW-WATER ECOLOGICAL STUDIES. Progressive Fish-Culturist, Vol. 26, No. 4, pp. 191-193.

The watertight housing is made of plexiglass (acrylic plastic). The controls are brass copper tube fittings penetrated by 1/4-inch welding rod. (Auth.)

7130. Robins, G. Lewis (International Pacific Salmon Fish. Comm., New Westminster, British Columbia, Canada). 1964. THE EFFECT OF COLUMNARIS IN MATURE SOCKEYE AND PINK SALMON ON THE VIABILITY OF THEIR EGGS AND SPERM. Progressive Fish-Culturist, Vol. 26, No. 4, pp. 186-187.

Controlled laboratory experiments indicate that infection of the eggs and sperm of mature sockeye (Oncorhynchus nerka) and pink salmon (O. gorbuscha) with columnaris resulted in a lower survival rate and some deformed embryos. (Auth.)

7131. Henegar, Dale L., and Donald C. Duerre (Game & Fish Dept., Bismarck, North Dakota). 1964. MODIFIED CALIFORNIA FISH DISTRIBUTION UNITS FOR NORTH DAKOTA. Progressive Fish-Culturist, Vol. 26, No. 4, pp. 188-190.

As a three-compartment tank built to California specifications did not meet distribution requirements in North Dakota, it has been replaced with three-tank units and one-tank trailers incorporating many modifications of the basic tank design.

7132. Hobart, Richard A. (U. S. Fish & Wildlife Service, Bur. Comm. Fish., Juneau, Alaska). 1964. LARGE PETERSEN DISK TAGS FOR STUDYING INTRASTREAM MIGRATIONS OF INDIVIDUAL SALMON. Progressive Fish-Culturist, Vol. 26, No. 4, p. 174.

7133. Sills, Joe B. (Bur. Sport Fish. and Wildlife, P. O. Box 766, Stuttgart, Arkansas). 1964. A NEW METHOD FOR SUPPLYING OXYGEN TO HOLDING TANKS. Progressive Fish-Culturist, Vol. 26, No. 4, p. 166.

7134. Johnson, M. G. (Metropolitan Toronto & Region Conservation Authority, Woodbridge, Ont., Canada). 1964. PRODUCTION OF BROOK TROUT IN EIGHT ONTARIO FARM PONDS. Progressive Fish-Culturist, Vol. 26, No. 4, pp. 147-154.

Fingerling brook trout (Salvelinus fontinalis) reached lengths of about 5, 7, and 9 inches by October of the first, second, and third years after stocking in six ponds in June 1959. Yearling trout attained lengths of about 8, 9, and 11 inches each fall after stocking in two ponds. Growth rates were reduced by the presence of coarse fish (mainly which suckers, Catostomus commersoni, and creek chub, Semotilus atromaculatus) and by the heaviest stocking rates used. Approximately 70% of the trout survived to the first fall, 25% to the second, and 10% to the third. Survival was not influenced by stocking rate but was poorer than average where fingerling trout were stocked into coarse-fish populations.

Maximum standing crops usually occurred in the second year and declined thereafter. Production was influenced by the age and magnitude of the standing crop of trout and the presence or absence of coarse fish. The low average annual harvest of trout, 8.6 pounds per acre, resulted from (a) inadequate fishing pressure, particularly when standing crops were greatest and about to decline, and (b) poorer standing crops and harvest rates of trout associated with coarse fish. Angling success, which averaged 2.2 trout per man-hour, was influenced more by the standing crop of trout on hand than by the amount of fishing effort expended. (Auth.)

7135. Phillips, Arthur M., Jr., Glen L. Hammer, John P. Edwards, and Henry F. Hosking (U. S. Fish and Wildlife Service, Cortland, New York). 1964. DRY CONCENTRATES AS COMPLETE TROUT FOODS FOR GROWTH AND EGG PRODUCTION. Progressive Fish-Culturist, Vol. 26, No. 4, pp. 155-159.

Over a 24-month period three pelleted foods fed as complete diets maintained brown trout (Salmo trutta) at satisfactory growth rates and with efficient conversions of food into flesh. Mortalities were normal. There was no evidence of anemia. Suggestions are made to correct nutritional disorders that appeared during the experiment. Fish fed one mixture produced excellent eggs whose survival compared favorably with that of eggs spawned from fish fed meat-meal mixtures under similar hatchery

conditions. Eggs from fish fed the other two dry mixtures were inferior. (A. M. Phillips, Jr.)

7136. Dollar, Alexander M., and Max Katz (College of Fish., Univ. of Washington, Seattle). 1964. RAINBOW TROUT BROOD STOCKS AND STRAINS IN AMERICAN HATCHERIES AS FACTORS IN THE OCCURRENCE OF HEPATOMA. Progressive Fish-Culturist, Vol. 26, No. 4, pp. 167-174.

Most present-day rainbow trout (Salmo gairdneri) brood stocks originate from the McCloud River in California. These have been isolated or cross-bred with other strains, or closely related species, in National, State, and commercial hatcheries. Information on the relationships of many of these strains has been summarized in a chart. The most important domesticated strain, serving as a basic brood stock, is the rainbow trout that has been maintained at the National Fish Hatchery at Wytheville, Virginia, since the 1880's. This original stock has been distributed within the United States and to foreign countries. One of the principal points for culturing of stock derived from the Wytheville parents is the National Fish Hatchery at Neosho, Missouri. The brood stocks at Neosho and at the National Fish Hatchery at Manchester, Iowa, originally transferred from the Wytheville hatchery, probably have been interbred with other trout strains. Information about State and commercial brood stocks has been reviewed, but information of this type is very limited. Before the genetic history of rainbow trout can be fully understood, more information on the interbreeding of strains and details on the selection criteria used by fish culturists will be required. (A. M. Dollar)

7137. Allbaugh, Clyde A., and Jerry V. Manz (Dept. Natural Resources, Div. of Wildlife, Sandusky, Ohio). 1964. PRELIMINARY STUDY OF THE EFFECTS OF TEMPERATURE FLUCTUATIONS ON DEVELOPING WALLEYE EGGS AND FRY. Progressive Fish-Culturist, Vol. 26, No. 4, pp. 175-180.

Analysis of April water-temperature records at the Put-In-Bay State Hatchery on South Bass Island in western Lake Erie, indicated that developing walleye (Stizostedion v. vitreum) eggs had been subjected to fluctuations as high as 8° F over a 24-hour period. An experiment designed to test the effects of water-temperature fluctuations above a base temperature on the development and/or survival of walleye eggs and fry under laboratory conditions was conducted during the 1961 hatching season. The percent of hatch in the controls closely approximated that recorded in the Put-In-Bay Hatchery. Eggs in experimental jars, subjected to an 8° F fluctuation above the base temperature, showed a slight increase in the percent of hatch at cleavage, a significant increase at organogenesis, but none at differentiation. Between 388 and 391 thermal units were required for normal hatching of walleye eggs. (C. A. Allbaugh)

7138. Franklin, John (Dept. Zoology, Southern Illinois Univ., Carbondale). 1964. AEROBIC BACTERIA IN THE INTESTINE OF THE GOLDEN SHINER. Progressive Fish-Culturist, Vol. 26, No. 4, pp. 160-166.

Nine aerobic bacteria genera--Escherichia, Pseudomonas, Aerobacter, Flavobacterium, Achromobacter, Alcaligenes, Proteus, Aeromonas, and Bacillus--were isolated and identified from the intestines of golden shiners (Notemigonus crysoleucas) taken from a pond, a lake, and a river in southern Illinois. The genera in the intestines were essentially the same, regardless of the source from which the fish were taken. The same bacterial genera were present in the intestines of both fasting and feeding fish. The number of genera isolated declined during October and November and increased in April and May. Direct plate count comparisons, made on washings of segments of the intestine after fasting and feeding periods, indicated that the bacteria multiply in the intestine of this fish. The regularity of occurrence of Escherichia, Aerobacter, Pseudomonas, and Flavobacterium indicated that they constitute a "normal" flora of the intestines of the golden shiner in southern Illinois waters. (Auth.)

7139. Gulland, J. A. (Fish. Div., Biology Branch, Food and Agriculture Organization of the United Nations, Rome, Italy). 1964. MANUAL OF METHODS OF FISH POPULATION ANALYSIS. FAO Fisheries Technical Paper No. 40, 63 pp.

This is a provisional edition of a manual giving an account of purposes and methods of estimation of parameters and assessment in fish population analysis. Examples are given to demonstrate applications of methods.

7140. Anonymous. 1964. REPORT OF THE FIRST SESSION OF THE FAO EXPERT PANEL FOR THE FACILITATION OF TUNA RESEARCH. FAO Fisheries Reports, No. 18, 23 pp.

This report of the first session of the FAO Expert Panel for the Facilitation of Tuna Research gives background information on the organization, terms of reference, composition, and procedures of the panel, agenda of the first session and conclusions and recommendations approved during the session. It appends a list of the members of the panel, participants at the first session and a list of working and information papers considered by the panel.

7141. Davis, Charles C. (Dept. Biol., Western Reserve Univ., Cleveland, Ohio). 1964. EVIDENCE FOR THE EUTROPHICATION OF LAKE ERIE FROM PHYTOPLANKTON RECORDS. Limnology and Oceanography, Vol. IX, No. 3, pp. 275-283.

The Division Avenue Filtration Plant of the Cleveland Division of Water and Heat has undertaken almost daily phytoplankton counts of water samples from Lake Erie since 1919. Data exist for 25 full years and for 7 additional partial years between 1919 and 1963. There has been a consistent increase in the average quantity of phytoplankton.

The vernal and autumnal phytoplankton maxima have consistently become more intense and have lasted longer. The periods of minimum phytoplankton development in winter and summer have become shorter and less well marked, until the winter minimum failed to develop at all in some of the latest years. Certain marked qualitative changes also have occurred. These effects are thought to have been caused by an increasingly rapid eutrophication of the water in Lake Erie. (Auth. Abst.)

7142. Anderson, George C. (Dept. of Oceanography, Univ. of Washington, Seattle). 1964. THE SEASONAL AND GEOGRAPHIC DISTRIBUTION OF PRIMARY PRODUCTIVITY OFF THE WASHINGTON AND OREGON COASTS. Limnology and Oceanography, Vol. IX, No. 3, pp. 284-302.

The distribution of chlorophyll a and phytoplankton productivity off the Washington and Oregon coasts has been observed during 14 cruises of the RV Brown Bear from January 1961 to June 1962.

Surface waters in the area covered by the Columbia River effluent generally contained more phytoplankton and had a higher rate of photosynthesis than ambient waters. The densest and most variable populations were found during summer in coastal upwelling areas and directly off the river mouth. Although there was little seasonal change in standing stock, production was quite variable, with minima in winter and summer, a large spring bloom, and a smaller autumn pulse.

The major influence of Columbia River water on phytoplankton production appeared to be in the timing of events in the seasonal cycle. Phytoplankton development was noticeably affected by differences in the depth of the mixed layer and the sharp pycnocline during summer. However, total annual production both inside and outside the plume was similar (60 g C m^{-2} yr^{-1}). The nutrients introduced by river water appeared to be spent in high-production areas immediately off the mouth of the river.

The seasonal variation of C^{14} uptake-chlorophyll a ratios was marked. Low values occurred during winter, and a maximum occurred during the spring bloom. "Dead" or inactive chlorophyll appeared to be negligible at all times, judging from regressions of these relationships. (Auth. Abst.)

7143. Nicholson, H. Page, Alfred R. Grzenda, Gerald J. Lauer, William S. Cox, and John I. Teasley (U. S. Dept. Health, Education, and Welfare, Public Health Service, Div. Water Supply and Pollution Control, Region IV, Atlanta, Georgia). 1964. WATER POLLUTION BY INSECTICIDES IN AN AGRICULTURAL RIVER BASIN. I. OCCURRENCE OF INSECTICIDES IN RIVER AND TREATED MUNICIPAL WATER. Limnology and Oceanography, Vol. IX, No. 3, pp. 310-317.

Insecticide contamination was studied in a stream from the summer of 1959 through the winter of 1962-63. The stream drains a 400-square-mile (1,036-km^2) watershed in northern Alabama, in which approximately 15,000 acres (6,070 ha) of cotton are cultivated annually. Estimates of insecticide usage on cotton varied from 58,000 lb technical (26.3 metric tons) in 1960 to 139,000 lb (63.0 metric tons) in 1962. Toxaphene, DDT, and BHC (benzene hexachloride) comprised over 90% of the insecticides used.

Water was sampled by the carbon adsorption method at a municipal water treatment plant. The data are reported as concentrations of insecticide recovered.

DDT was never detected, but toxaphene and BHC were detected in all samples. Toxaphene ranged from 7 to 410 parts per trillion (ppt), and BHC from 7 ppt to 1.0 part per billion (ppb). Samples of treated and untreated water showed that the purification process failed to remove toxaphene and BHC. Samples taken in the summer of 1960 from the stream system indicated the same order of contamination observed at the water treatment plant. The data suggest that soil-persistent insecticides in the stream are related to levels of usage and to the solubility of the compounds. (Authors)

7144. Grzenda, Alfred R., Gerald J. Lauer, and H. Page Nicholson (U. S. Dept. Health, Education, and Welfare, Public Health Service, Div. of Water Supply and Pollution Control, Region IV, Atlanta, Georgia). 1964. WATER POLLUTION BY INSECTICIDES IN AN AGRICULTURAL RIVER BASIN. II. THE ZOOPLANKTON, BOTTOM FAUNA, AND FISH. Limnology and Oceanography, Vol. IX, No. 3, pp. 318-323.

In 1959 and 1960, zooplankton, bottom fauna, and fish populations were studied in a drainage system polluted with insecticides in northern Alabama. Toxaphene and BHC (benzene hexachloride) were present in all water samples collected in 1959 and 1960 in concentrations considered to be sublethal to aquatic animals in a single dose.

There was no convincing evidence that continuous toxaphene and BHC contamination resulted in gross damage to zooplankton, bottom fauna, and fish populations. Zooplankton was sparse at all times. However, this scarcity was attributed to other unfavorable environmental conditions, such as changes in discharge and high turbidity. A considerable variety of bottom fauna taxa was noted in all collections. There were fluctuations in the abundance of bottom fauna during the period of study. However, the data did not suggest that these were caused by insecticide contamination. Fish collections from two stations in June and September of 1959 and 1960 contained a variety of fishes represented by many size classes. There was additional evidence that the drainage system supported a sizable fish population of diverse taxonomic structure. (Authors)

7145. Aron, William, Newell Raxter, Roy Noel, and William Andrews (GM Defense Research Laboratories, General Motors Corp., Santa Barbara, California). 1964. A DESCRIPTION OF A DISCRETE DEPTH PLANKTON SAMPLER WITH SOME NOTES ON THE TOWING BEHAVIOR OF A 6-FOOT ISAACS-KIDD MID-WATER TRAWL AND A ONE-

METER RING NET. Limnology and Oceanography, Vol. IX, No. 3, pp. 324-333.

This paper describes an electrically operated sampling system developed for capturing pelagic animals at a known depth while also providing a continuous shipboard record of the depth of the net and the temperature of the water being sampled. It includes data on the towing behavior of a 6-ft Isaacs-Kidd mid-water trawl and a 1-m ring net that were obtained with the new sampler. (Authors)

7146. Gold, Kenneth (Lamont Geological Observatory of Columbia Univ., Palisades, New York). 1964. A MICROBIOLOGICAL ASSAY FOR VITAMIN B_{12} IN SEA WATER USING RADIOCARBON. Limnology and Oceanography, Vol. IX, No. 3, pp. 343-347.

A new method for assaying vitamin B_{12} in seawater using the marine diatom Cyclotella nana Hustedt is described. The criterion of response to variations in B_{12} concentration was C^{14} assimilation (added as $Na_2C^{14}O_3$) after 24-hr exposure to the vitamin. C^{14} assimilation was proportional to the B_{12} content of the medium in an ecologically useful range (0.1-6μμg B_{12}/ml). (Auth. Abst.)

7147. Jeffries, Harry P. (Graduate School of Oceanography, Univ. of Rhode Island, Kingston). 1964. COMPARATIVE STUDIES ON ESTUARINE ZOOPLANKTON. Limnology and Oceanography, Vol. IX, No. 3, pp. 348-358.

The seasonal cycle of zooplankton in Raritan Bay, New Jersey, was compared with Narragansett Bay, Rhode Island, and the York River, Virginia, to determine the effects of local conditions on latitudinal gradients in species distributions. The dominant copepods in each estuary, Acartia clausi and A. tonsa, alternated cycles of abundance in a similar and predictable manner, and the distribution of Eurytemora spp. reflected the salinity distribution in several embayments. Relative proportions of the major groups comprising the temporary plankton differed significantly between estuaries. Paucity of lamellibranch larvae in the Raritan system probably resulted from organic debris in the water column, whereas the importance of Balanus nauplii in the York River appeared to be the expression of a natural zoogeographic pattern.

Local irregularities were noticed in Raritan Bay when A. tonsa disappeared during summer. This highly abnormal situation paralleled drastic fluctuations in the phytoplankton. Lamellibranch veligers and Balanus nauplii increased in numbers where pollution had been reduced. Plant nutrients arising from discharged wastes and land runoff produced fertile conditions for an extremely dense and persistent spring bloom of phytoplankton. The overabundance of food or associated factors may have been responsible for delayed reproduction by Balanus and polychaetes. (Auth. Abst.)

7148. Jitts, H. R. (Commonwealth Scientific and Industrial Research Organization, Div. of Fish. and Oceanog., Cronulla, Sydney, Australia). 1964. A TWIN SIX-LITER PLASTIC WATER SAMPLER. Limnology and Oceanography, Vol. IX, No. 3, p. 452.

7149. Dodson, Anne N., and William H. Thomas (Scripps Inst. of Oceanog., La Jolla, Univ. of California, San Diego). 1964. CONCENTRATING PLANKTON IN A GENTLE FASHION. Limnology and Oceanography, Vol. IX, No. 3, pp. 455-456.

7150. MacIntyre, R. J. (Commonwealth Scientific Industrial Research Organication, Div. of Fish. and Oceanog., Cronulla, Sydney, Australia). 1964. A BOX DREDGE FOR QUANTITATIVE SAMPLING OF BENTHIC ORGANISMS. Limnology and Oceanography, Vol. IX, No. 3, pp. 460-461.

7151. Ball, John N., and Grace E. Pickford (Dept. Zool., Univ. of Liverpool, Liverpool, England). 1964. PITUITARY CYTOLOGY AND FRESHWATER ADAPTATION IN THE KILLIFISH, FUNDULUS HETEROCLITUS. Anatomical Record 148 (2): 358.

7152. Tsuyuki, Henry, and Finn Wold (Fisheries Research Board of Canada, Technological Station, Vancouver 8, B. C., Canada). 1964. ENOLASE: MULTIPLE MOLECULAR FORMS IN FISH MUSCLE. Science, Vol. 146, No. 3643, pp. 535-537.

Starch-gel electrophoresis shows three distinct molecular forms of enolase in each of eight different species of Salmonidae. The three enolases do not appear to be artifacts of isolation, and their electrophoretic patterns are completely reproducible. The patterns are also highly characteristic for each individual species of fish, and together with the overall myogen patterns they represent unequivocal means of taxonomical identification. (Authors)

7153. Margalef, Ramon (Instituto de Investigaciones Pesqueras, Paseo Nacional, s/u. Barcelona 3, Spain). 1964. EXPERIMENTAL MODELS OF PHYTOPLANKTON POPULATIONS: FURTHER OBSERVATIONS ON PIGMENTS AND FIXATION OF INORGANIC CARBON. (MODELOS EXPERIMENTALES DE POBLACIONES DE FITOPLANCTON: NUEVAS OBSERVACIONES SOBRE PIGMENTOS Y FIJACIÓN DE CARBONO INORGÁNICO.) Investigacion Pesquera, Vol. 26, pp. 195-203.

Discussed are some results gathered from further operation of the experimental device described in Margalef (1963). Nice duplications of "spring blooms" of Skeletonema and other phytoplankters can be achieved with regularity. The ratio D_{430}/D_{665} (absorbancies at the stated wavelengths of the acetonic extracts of plankton) is a good indicator of the physiological state of populations. At the beginning of the bloom, with a vertical gradient of light and uniform vertical distribution of nutrients, the value of D_{430}/D_{665} increases downward. In an advanced stage or toward the end of the bloom, with the same light gradient, but with a strong stratification of nutrients, it decreases

downward, as it were strongly dependent from nutrient concentration and perhaps also from speed of sedimentation, rather than from intensity and quality of light.

In cultures in which 14-C was added close to the surface, migration of the radioactivity in seston shows the combined effects of assimilation and sedimentation of cells. After darkening of the cultures an impressive fixation of 14-C by bacteria has been observed, and it seems that it comes not only from organic material assimilated and excreted by the algae in the phase of active growth, or from dead algae, but also from direct fixation of inorganic carbon by bacteria. This fact helps to explain why, in certain conditions, production measurements by the Steemann-Nielsen method gives very high 14-C fixation values in the dark bottles. This happens mostly in polluted waters with rich bacterial flora, and also in offshore situations, where the plankton is sparse and delicate and dies and decomposes in the flasks in a fair proportion. (Auth. Summ.)

7154. Vernon, E. H. (International Pacific Salmon Fish. Comm., New Westminster, B. C., Canada), A. S. Hourston, and G. A. Holland. 1964. THE MIGRATION AND EXPLOITATION OF PINK SALMON RUNS IN AND ADJACENT TO THE FRASER RIVER CONVENTION AREA IN 1959. International Pacific Salmon Fisheries Comm., Bulletin XV, 296 pp.

Previous investigations indicated that maturing pink salmon, on reaching coastal waters, enter the Convention area from the south through Juan de Fuca Strait and from the north through the Strait of Georgia after passing through Queen Charlotte and Johnstone Straits. The present cooperative program involved tagging the run on both approaches and following the migration of these fish through the recovery of tags in subsequent fisheries and on spawning grounds. In addition a more or less complete census of the population both by area and by time was obtained by the enumeration of weekly catches in 31 individual fishing areas and of spawners in 157 individual streams.

More than 53,000 tags were applied along the migration route, 32,000 of which were recovered from the 5.6 million fish examined for tags in the catches and on the spawning grounds. The fishing area and week of capture were established for practically all of the 7.6 million pink salmon caught by commercial and sport fishermen during the migration. The 2.6 million spawners were enumerated mainly by stream tagging and recovery programs, involving the tagging of a further 52,000 pinks and the examination of over 360,000 carcasses for tags.

Of the 10,264,000 pink salmon that entered the Study Area in 1959, 3,776,000 came from the north via Queen Charlotte Strait and 6,488,000 entered from the south. Of these fish entering the Study Area, 63 percent were destined for the Fraser, 24 percent were destined for other Canadian streams, and 12 percent were destined for United States streams.

Fraser River fish accounted for 71 percent of the 7,622,000 pink salmon caught in the Study Area in 1959. Canada Non-Fraser fish provided a catch of 20 percent and United States fish 9 percent. The catch was almost evenly divided between the Canadian Non-Convention area, the Canadian Convention area and the United States Convention area fisheries each of which took about two and a half million pinks. (From Auth. Summ.)

7155. Walker, D. C. 1963. NEW INSTRUMENT FOR MEASURING EVAPORATION; APPLICATION TO EVAPORATION OF WATER THROUGH THIN FILMS. Rev. sci. Instrum., 34, 1006-1009; Water Pollution Abstracts, Vol. 37, No. 7, Abst. No. 1109. 1964.

An illustrated description is given of apparatus for measuring evaporation, which is particularly useful for assessing the efficiency of monomolecular films for retarding evaporation from water surfaces. A probe passes helium over a small area of the water surface, and the vapor picked up by the helium returns through the probe and is measured continuously by a thermal conductivity cell. Results are accurate and reproducible, and the instrument is sensitive to a change in evaporation rate of less than 1 percent.

7156. Watson, D. G., and W. H. Rickard. 1963. GAMMA-EMITTING RADIONUCLIDES IN ALASKAN FISH AND PLANTS. U. S. Atom. Energ. Comm., HW-76000, 244-257; Nuclear Sci. Abstr., 17, 4716; Water Pollution Abstracts, Vol. 37, No. 7, Abst. No. 1199. 1964.

Measurements have been made of amounts of gamma-emitting radioactive isotopes in fish from sea water, brackish water, and fresh-water bodies in Alaska. Naturally occurring potassium-40 exceeded the quantity of fallout isotopes by a factor of 10-100. Zinc-65 was present in all fish from lakes and in anadromous salmon, but was absent from stream fish. Highest levels of caesium-137 occurred in the fresh-water lakes that collect runoff from the surrounding land.

7157. Bryan, G. W. 1963. THE ACCUMULATION OF RADIOACTIVE CAESIUM BY MARINE INVERTEBRATES. J. Mar. biol. Ass. U. K., 43, 519-539; Water Pollution Abstracts, Vol. 37, No. 7, Abst. No. 1201. 1964.

Previous work on the uptake of radioactive caesium and potassium metabolism in decapod crustacea has been extended by studies of the accumulation of caesium-137 from sea water by species from the principal marine invertebrate phyla. Uptake of caesium-137 was compared with uptake of potassium-42 and with the distribution of inactive potassium. Caesium-137 is always absorbed more slowly than potassium-42 from sea water, but at equilibrium concentration factors for caesium-137 usually exceed those for potassium-42 or inactive potassium. Caesium-137 is rapidly taken up by body fluids, but more slowly by tissues. In the case of potassium-42 and inactive potassium, the difference is not so marked. The author

suggests that there is a relationship between the final distribution in the body of caesium-137 and of inactive potassium.

7158. Bryan, G. W. 1963. THE ACCUMULATION OF CAESIUM-137 BY BRACKISH-WATER INVERTEBRATES AND ITS RELATION TO THE REGULATION OF POTASSIUM AND SODIUM. J. Mar. biol. Ass. U. K., 1963, 43, 541-565; Water Pollution Abstracts, Vol. 37, No. 7, Abst. No. 1202. 1964.

Previous work on the accumulation of radioactive caesium by marine invertebrates has been extended by studies of the relation between the ability of brackish-water invertebrates to regulate sodium and potassium and the accumulation of caesium-137. Sphaeroma hookeri and Potamopyrgus jenkinsi were acclimated to a range of sea-water dilutions. In both species sodium and potassium fell with increasing dilution to a lower level which was still higher than that of the medium. In dilute sea water both conserve potassium rather than sodium; caesium-137 behaves more like potassium than sodium. Uptake of potassium-42 and caesium-137 was investigated in a range of sea-water dilutions. Potassium-42 is exchanged for inactive potassium more rapidly in higher sea-water concentrations; the author suggests that this may be due to an exchange diffusion component which increases with the salinity of the medium. Caesium-137 is accumulated to concentration factors approximately double those of inactive potassium over a sea-water concentration range of 2.5-100 percent. Brackish-water species are, therefore, potentially a greater hazard than marine species since they accumulate caesium-137 to high levels in dilute media.

7159. Carter, L. 1963. TOXICITY OF TRADE WASTES TO FISH. Effl. & Wat. Treatm. J., 3, 206-208; Water Pollution Abstracts, Vol. 37, No. 7, Abst. No. 1207. 1964.

The author discusses bioassay techniques for determining toxicity of effluents to fish, with particular reference to materials and methods, two methods of expressing the results, and the advantages of this technique.

7160. Jamnback, H., and H. S. Eabry. 1962. EFFECTS OF DDT, AS USED IN BLACK FLY LARVAL CONTROL, ON STREAM ARTHROPODS. J. econ. Ent., 55, 636-639; Publ. Hlth Engng Abstr., 43, 32; Water Pollution Abstracts, Vol. 37, No. 7, Abst. No. 1208. 1964.

Results of a study, carried out in 1961 to determine the possible cumulative effects of DDT on aquatic arthropods, are summarized in tables and discussed. The streams investigated had been treated with DDT for 5-10 years to control blackfly larvae, and statistical analyses, based on riffle samples from treated and untreated Adirondack mountain streams, indicate that a significantly smaller number of Ephemeroptera and Diptera were present in the regularly-treated streams than in untreated streams; the reduction in overall numbers of arthropods, however, did not reach a significant level. The numbers of arthropods in 11 regularly-treated streams sampled in 1950-52 and again in 1961 were approximately the same. The ratio of weight:volume:numbers of arthropods was about the same in regularly-treated, irregularly-treated, and untreated streams sampled in 1961.

7161. Shelbourne, J. E., J. D. Riley, and G. T. Thacker (Fisheries Laboratory, Lowestoft, England). 1963. MARINE FISH CULTURE IN BRITAIN. I. PLAICE REARING IN CLOSED CIRCULATION AT LOWESTOFT, 1957-1960. J. Cons. int. Explor. Mer., Vol. XXVIII, No. 1, pp. 50-69.

A project ultimately aimed at mass-producing metamorphosed fish from plaice eggs was started at Lowestoft in 1957. The first experiments were conducted on sea-spawned eggs in a 200:1 closed circulation of sea water, using photosynthesizing plants (Enteromorpha) to control metabolites. This system was superseded in 1959 by an 11,000:1 circulation comprising separate reservoir and hatchery, which was further expanded to 15,750:1 in 1960.

An empirical plaice rearing technique has been steadily developed which takes into account some of the main physico-chemical and biotic factors peculiar to aquaria. Total annual production of metamorphosed fish since 1957 has been 1, 100, 300, and 1200 in successive years, representing a 3-5% survival from the egg stage. Occasional survivals as high as 10% at a density of 500 fish per m^2 have occurred in individual tanks. Mortality rates under our hatchery regime were generally highest (a) between hatching and first-feeding, (b) between the onset and completion of metamorphosis. The size range of survivors from any one tank after four months in the aquarium was characteristically wide, extending from 10 mm to a maximum of 50 mm. Only 62% of the final stock in 1960 were normally pigmented on the dorsal side, and in the one tank where an accurate estimate was possible, 25% had bitten fins. (Auth. Summ.)

7162. Shelbourne, J. E. (Fisheries Laboratory, Lowestoft, England). 1963. MARINE FISH CULTURE IN BRITAIN. II. A PLAICE REARING EXPERIMENT AT PORT ERIN, ISLE OF MAN, DURING 1960, IN OPEN SEA WATER CIRCULATION. J. Cons. int. Explor. Mer., Vol. XXVIII, No. 1, pp. 70-79.

The Lowestoft plaice rearing technique, originally developed in closed circulation, was tested in an open sea water circulation at Port Erin, Isle of Man, during 1960, using pond-spawned eggs for the first time. Six small glass tanks (60 cm x 30 cm x 30 cm) were stocked with either 1 or 2 thousand eggs, batches being in different states of development. The mean survival beyond metamorphosis was 6.1% at a density of 383 fish per m^2, though four out of the six tanks

gave a mean survival approaching 10% at a density of 493 fish per m^2. The mortality curve for each tank showed two characteristic periods of accelerated larval mortality - one between hatching and first-feeding, the other between the onset and completion of metamorphosis.

Length measurements of survivors from most tanks ranged between 10 mm and 40 mm in roughly equal conditions of food, temperature, salinity, and pH. Thirty-five and four-tenths percent of all fish were found to be bitten on the tail or fins, the smaller fish suffering most. Fifty-five percent of the surviving stock showed normal dorsal pigmentation and 36.5% had a variable degree of pigment on the ventral side. There was a strong correlation between size, pigment normality and percentage pigment cover. As a general rule, the bigger fish among a tank population are likely to be more heavily pigmented, under the present technical regime. (Auth. Summ.)

7163. Riley, John D., and Graham T. Thacker (Fisheries Laboratory, Lowestoft, England). 1963. MARINE FISH CULTURE IN BRITAIN. III. PLAICE (PLEURONECTES PLATESSA (L.)) REARING IN CLOSED CIRCULATION AT LOWESTOFT, 1961. J. Cons. int. Explor. Mer., Vol. XXVIII, No. 1, pp. 80-90.

Improvements in the control of sea water conditions in a closed circulation for plaice rearing led to an increase in the number of plaice reared through metamorphosis.

Nitrate and nitrite estimations throughout the rearing demonstrated the efficiency and shortcomings of dependence upon water-conditioning flora in closed circulation.

Two thousand eight hundred and seven fish survived out of 84,000 eggs after 140 days in the closed sea water circulation, a 3.3% survival; of these 61% were perfectly pigmented. The mean percentage pigmentation increased slightly with size.

The chances of a fish being bitten were increased with small size, pigment deficiency, and high fish density. (Auth. Summ.)

7164. Kabata, Z. (Marine Laboratory, Aberdeen, Scotland). 1963. INCIDENCE OF COCCIDIOSES IN SCOTTISH HERRING (CLUPEA HARENGUS L.). J. Cons. int. Explor. Mer., Vol. XXVIII, No. 2, pp. 201-210.

The livers and the male gonads of 8,690 herring from the northern North Sea and the west coast of Scotland were examined for the incidence of the cysts of Eimeria clupearum and E. sardinae, with the view of determining the usefulness of these parasites as biological indicators. It has been found that no differences existed between infection of herring from different localities in these areas and that, therefore, these parasites are not suitable for this purpose. It has also been found that both parasites tend to increase in indicence with the age of the host and that the high level of infection appears to show some tendency to decline after the fish has reached the age of about six years. The incidence also fluctuates seasonally, its lowest level falling in the summer months and the peak in the late winter or early spring months. No relationship was discovered between these fluctuations and the reproductive cycle of the host. (Auth. Summ.)

7165. Blaxter, J. H. S. (Marine Laboratory, Aberdeen, Scotland), and G. Hempel. 1963. THE INFLUENCE OF EGG SIZE ON HERRING LARVAE (CLUPEA HARENGUS L.). J. Cons. int. Explor. Mer., Vol. XXVIII, No. 2, pp. 211-240.

This paper describes the results of experimental rearing of herring larvae derived from eggs of different size and origin. Comparisons were made between important spawning groups as well as within these groups. The main characters investigated were length and height of body, dry weight of larvae and yolk sacs, the duration of the yolk sac stage, and the time larvae could live without food.

The comparison between the groups showed that larvae from groups with big eggs, such as Norwegian and Downs herring, were about 8 mm long (~0.1 mg dry matter/larva) at hatching, the yolk sacs being heavier than the larval bodies. In groups with small eggs, such as Baltic and Buchan, the larvae hatched at about 6 mm (0.05 mg dry matter/larva); the yolk sacs were small, in Kiel larvae being almost absent at hatching. Groups with medium-sized eggs, such as Clyde and Dogger, produced larvae of intermediate size and yolk supply at hatching. Although the incubation time was independent of egg size, the yolk sac stage was much longer in larvae from big eggs than in those from small eggs (14:4 days).

When the larvae were not fed they reached their maximum weight and length at about the end of the yolk sac stage. The overall daily larval growth rate during the yolk sac stage was rather similar in most groups, being about 0.16 mm in length and 0.003-0.004 mg dry weight. Afterward, up to death by starvation, non-fed larvae shrank and lost weight (~40%). Within the normal range, temperature had only a small effect on larval size, both at hatching and at the end of the yolk sac stage.

Larvae from big eggs lived for about 28 days after hatching at 8° C if no food was offered. Larvae from small eggs lived on an average only for about 15 days, larvae from medium-sized eggs showing intermediate survival times. Survival time seemed to depend on the yolk sac:body weight relationship in newly-hatched larvae.

The experimental results were applied to the different conditions met by the larvae of the different spawning groups in the sea. Those groups spawning in winter have bigger larvae with longer survival than summer spawners.

Under natural conditions larvae have to start feeding within the first week after the end of the yolk sac stage, otherwise they become sluggish and die of starvation. Experiments showed that this 'point of no return' was reached when some three-quarters of the survival time had elapsed.

Egg size, and accordingly larval size, was

less variable within a single group than between the groups described. Larval size at hatching was not significantly correlated with differences in egg size within a group. However, the volume and weight of the yolk sacs at hatching increased with egg size within most of the groups. In some groups larval size at the end of the yolk sac stage and survival time increased significantly with egg size.

The experimental data suggest that although eggs tend to be somewhat smaller in recruit spawners, a reduction in the mean age of a spawning stock should not lead to a disastrous reduction in the survival of the larvae. Differences in temperature and salinity should not have a strong direct influence on the larvae. It may be assumed that other changes in the environment are far more important for determining the survival of herring larvae from year to year. (Auth. Summ.)

7166. Shelbourne, J. E. (Fisheries Laboratory, Lowestoft, England). 1963. MARINE FISH CULTURE IN BRITAIN. IV. HIGH SURVIVALS OF METAMORPHOSED PLAICE DURING SALINITY EXPERIMENTS IN OPEN CIRCULATION AT PORT ERIN, ISLE OF MAN, 1961. J. Cons. int. Explor. Mer., Vol. XXVIII, No. 2, pp. 246-261.

The plaice-rearing work at Port Erin, Isle of Man, in 1961, took the form of a long-term salinity experiment, using an apparatus designed to produce a constant flow of salinity-adjusted sea water through rearing tanks. Nine tanks were employed, grouped in three units of three, each tank being stocked with 1000 plaice eggs (gastrulae) collected from a spawning pond. Toward the end of the 'critical period' between hatching and larval 'first-feeding,' the salinity was lowered in two of these units to a level 1.5 0/00 below the hatchery norm (34 0/00), at a rate of 0.5 0/00 per day. The sea water diluent was distilled water from a cast-iron still. Unexpected larval mortalities accompanied this treatment; it is not at all certain that the slight salinity change was directly responsible.

The experiment was repeated on surviving stock at a later stage of larval development. There was no differential mortality in tanks irrigated with sea water of 31 0/00 and 28 0/00 salinity, using tap water and iron-distilled water as diluents. Mortalities in control tanks (34 0/00) were higher than in treated tanks during the second experiment, but this may have been due to higher population density. The tentative conclusion is reached that salinity stabilization may not be a major consideration in the control system of a large-scale plaice hatchery, at least during the later stages of larval development.

Final survivals to metamorphosis in the three control tanks were 36%, 33%, and 31% of original eggs at a mean density of 1790 young fish per m^2 -- about three times the best survivals in past seasons. This improvement probably reflected refinements in rearing technique, particularly in respect of tank illumination at 'first-feeding,' tank design and tank hygiene.

Length measurements of metamorphosed survivors ranged between 10 and 45 mm, demonstrating individual variations in adaptability to tank conditions. More densely populated tanks contained higher proportions of smaller survivors. As in 1960, there was a relationship between survivor size and the incidence of bitten fins; also a strong correlation between size and dorsal pigment. As a general rule, the bigger fish among a tank population stand a better change of being more heavily pigmented, under the present technical regime.

7167. Mitson, R. B. (Fisheries Laboratory, Lowestoft, England). 1963. MARINE FISH CULTURE IN BRITAIN. V. AN ELECTRONIC DEVICE FOR COUNTING THE NAUPLII OF ARTEMIA SALINA L. J. Cons. int. Explor. Mer., Vol. XXVIII, No. 2, pp. 262-269.

A simple electronic counter for Artemia salina nauplii is described which has been used in feeding experiments of plaice larvae (Pleuronectes platessa L.). This counter was able to record up to 2,000 nauplii per second but during the 1962 plaice rearing season a rate of approximately 350 per second was used with total variation of $\pm$ 1.5%.

7168. Patten, Bernard C. (Radiation Ecology Sec., Health Physics Div., Oak Ridge National Laboratory, Oak Ridge, Tennessee). 1964. SOME EXPERIMENTAL CHARACTERISTICS OF DARK AND LIGHT BOTTLES. J. Cons. int. Explor. Mer., Vol. XXVIII, No. 3, pp. 335-353.

Experimental evaluation of several aspects of the dark and light bottle oxygen method for estimating aquatic production yielded the following results: (i) Precision, expressed as a standard deviation, averaged 0.025 mg oxygen/l for initial BOD bottles and 0.065 for initial citrate bottles. A variety of treatments for periods of 24 hours increased these values to 0.075 and 0.156, respectively. The average maximum error of a single dissolved oxygen determination was established as 1.8% of the mean, and the average probable error was 0.9%. The minimum precision, expressed as a maximum standard deviation, of single sample determinations of production variables was 0.15 mg/l for gross production and 0.10 for net production and respiration. (ii) Dissolved oxygen of a water sample was higher when determined with BOD bottles than with citrate bottles. (iii) Measured oxygen was observed to increase hyperbolically as Winkler reagent concentrations were increased in constant proportion. (iv) Iodine solutions stored in the dark at room temperature decayed at a rate equivalent to 0.016 mg oxygen/l per day. (v) There was preliminary evidence for a degree of oxygen exchange between the medium and BOD bottles during the exposure period. Citrate bottles did not appear to leak. (vi) No differences were observed in 24-hour results between bottles positioned vertically and others positioned horizontally. (vii) There was no evidence for differences between agitated and unagitated samples. (Auth. Summ.)

7169. Fahy, William E. (Univ. of North Carolina, Inst. of Fish. Research, Morehead City). 1964.

A TEMPERATURE-CONTROLLED SALT-WATER CIRCULATING APPARATUS FOR DEVELOPING FISH EGGS AND LARVAE. J. Cons. int. Explor. Mer., Vol. XXVIII, No. 3, pp. 364-384.

Details of construction are given for a temperature-controlled incubation apparatus that permits successful development of marine fish eggs and larvae under varied experimental conditions. In four, independent, closed systems, water is moved from a temperature establishing source to an elevated incubation tank by air-lift and is returned by gravity. Detailed instructions are provided for operation of the apparatus, including the handling of eggs and larvae, changing the water of a system without disturbing the experimental animals, and thorough cleaning of a system when such is necessary. A continuous, printed, temperature record for water in each incubation chamber is provided by a strip recorder. The experimental temperature range extends from a minimum at which water being used will flow to a maximum of +40.0° C; within this range any temperature can be held remarkably constant or any pulsing regime of temperature can be established. Recommendations are given citing precautions to be observed when operating the apparatus and when shutting it down. Suggestions are made to reduce electrical and mechanical failures in equipment. A method for reducing color and intensity of incident light on developing eggs and larvae during inspection is described. The advantages of this simple, versatile, dependable, and safe incubation apparatus for experimental study of meristic structures in developing fishes are enumerated. Mortalities of eggs and larvae for two experiments are presented.

7170. Gambell, R. (Marine Laboratory, Aberdeen, Scotland), and J. Messtorff. 1964. AGE DETERMINATION IN THE WHITING (MERLANGIUS MERLANGUS L.) BY MEANS OF THE OTOLITHS. J. Cons. int. Explor. Mer., Vol. XXVIII, No. 3, pp. 393-404.

This paper presents the conclusions resulting from the activities of an international working group set up by ICES a study age determination in whiting. The different methods of age determination are discussed and it is shown that the whiting otolith is a convenient and reliable structure from which the age of a fish can be estimated. The structure of the otolith is noted, and the time of the laying down of the opaque and hyaline zones is investigated. The main methods of reading the otolith, by transmitted or direct light, are described. The chief difficulties met in the interpretation of the otolith are illustrated, including the presence of double bands, and zones which are not annual structures. The size and spacing of the growth zones are considered. Reference is made to the appearance of otoliths from whiting caught in areas outside the northern North Sea, in which the opaque and hyaline zones are less well-defined. (Auth. Summ.)

7171. Patten, Bernard C. (Radiation Ecology Sec., Health Physics Div., Oak Ridge National Lab., Oak Ridge, Tennessee). 1964. THE RATIONAL DECISION PROCESS IN SALMON MIGRATION. J. Cons. int. Explor. Mer., Vol. XXVIII, No. 3, pp. 410-417.

A numerical probability model of homing migrations in Pacific salmon (Saila and Shappy, 1963, Abstract No. 6492) was criticized (i) for the severity of constraints required to apply it, and (ii) for its lack of relationship to salmon biology. A model of search behavior, based on statistical decision theory, was then developed, and a numerical extension employed to demonstrate that a low degree of rationality in the search process is sufficient to guarantee high probabilities of return to the natal stream. This agrees with the work of Saila and Shappy (1963), and negates the need for precise navigational ability. (Auth. Summ.)

7172. Ehlinger, Neil F. (New York State Cons. Dept., State Office Bldgs. Campus, Albany, New York). 1964. SELECTIVE BREEDING OF TROUT FOR RESISTANCE TO FURUNCULOSIS. New York Fish and Game Journal, Vol. 11, No. 2, pp. 78-90.

A program of selective breeding has been carried on to develop strains of brook trout and brown trout resistant to furunculosis. Diverse geographical strains of these species, obtained from stations in the United States and Canada, were intensively exposed to Aeromonas salmonicida, the etiological agent, and the less resistant individuals were removed by mass selection. Survivors were retained as brood fish for the next generation which was similarly exposed to disease, etc. Hybridization through crossing more promising strains in some instances improved resistance. Typical data are presented to demonstrate the variation among fingerlings and yearlings of resistant strains and to compare them with control strains. Resistant strains were also compared with regular hatchery stock under actual hatchery conditions. Results obtained thus far indicate that resistance to furunculosis is being achieved. The work is continuing. (Auth. Abst.)

7173. Burdick, G. E., Dean J. Howard, and Earl J. Harris (New York State Cons. Dept., Albany, New York). 1964. TOXICITY OF AQUALIN TO FINGERLING BROWN TROUT AND BLUEGILLS. New York Fish and Game Journal, Vol. 11, No. 2, pp. 106-114.

The toxicity of aqualin to fingerling brown trout and bluegills was determined by a procedure approximating the concentration to be expected to result from a single field application under certain conditions. Toxicity curves based on time-concentration relationships are presented. The 24-hour TLm was found to be 0.046 ppm for brown trout and 0.079 ppm for bluegills. Reduced toxicity resulting from increasing size was evident for bluegills, and a correction factor is presented for the size range covered. This effect was not clearly established for brown trout fingerlings. For both test organisms the threshold for

mortality was below the concentration recommended for controlling aquatic vegetation. (Auth. Abst.)

7174. Loeb, Howard A. (New York State Cons. Dept., Albany, New York). 1964. SUBMERGENCE OF BROWN BULLHEADS IN BOTTOM SEDIMENTS. New York Fish and Game Journal, Vol. 11, No. 2, pp. 119-124.

Under laboratory conditions brown bullheads buried themselves in lake bottom sediments at temperatures ranging from 32° to 65° F. At water temperatures of 46° F and above the mouth could always be seen above the mud or in a funnel just below the surface, and breathing was more or less continuous. At 43° F and below sediment often covered the mouth for hours. It is possible that the filtering action of sediments on poisons would make eradication of buried fish difficult. Brown bullheads remained active at 32° F as long as oxygen was available, but they succumbed to freezing. (Auth. Abst.)

7175. Jensen, Albert C. (U. S. Fish and Wildlife Service, Bur. Comm. Fish. Biol. Lab., Woods Hole, Massachusetts). 1964. WILDLIFE ECOLOGY OF A HEAVILY-USED AQUATIC AREA. New York Fish and Game Journal, Vol. 11, No. 2, pp. 132-147.

A study was made of a biotic community at the head of Jamesville Reservoir, an area under heavy, periodic recreational use, to determine seasonal changes in the kinds and numbers of animals present. Systematic sampling, supplemented with visual observations, were used to gather information on the principal organisms in the ecosystem. The animals found in the area were greatly affected by water-level fluctuations in the reservoir. Invertebrates that serve as food for fish, and the fish themselves, were forced to migrate as their habitat dried up. The recreational users of the area appeared to have relatively little effect on the vertebrates. (Auth. Abst.)

7176. Mack, G. L., S. M. Corcoran, S. D. Gibbs (New York State Agricultural Experiment Station, Geneva, New York), W. H. Gutenmann, J. A. Reckahn, and D. J. Lisk. 1964. THE DDT CONTENT OF SOME FISHES AND SURFACE WATERS OF NEW YORK STATE. New York Fish and Game Journal, Vol. 11, No. 2, pp. 148-153.

Sixteen species of fish taken from New York waters contained from 0.2 to 7.0 ppm of DDT on a fresh-weight basis. Certain tissues such as visceral fat, gills, eggs and the sex organs contained up to 40 ppm. The surrounding water and sedimentary mud contained much smaller amounts, indicating that fish may concentrate DDT in their tissues. Aldrin, dieldrin, lindane, chlordane, heptachlor and endrin were not detected at a sensitivity limit of 0.03 ppm. (Auth. Abst.)

7177. Harding, Robert J. (New York State Cons. Dept., Albany, New York). 1964. AN UNDERWATER SLED. New York Fish and Game Journal, Vol. 11, No. 2, pp. 157-158.

A sled for rapid means of underwater travel when using self-contained underwater breathing apparatus is described.

7178. Kelly, William H., and Howard A. Loeb (New York State Cons. Dept., Albany, New York). 1964. JAW MARKING TROUT WITH INJECTED DYES. New York Fish and Game Journal, Vol. 11, No. 2, pp. 159-160.

Ten water-soluble dyes were injected into the lower jaws of yearling brown trout and brook trout in an attempt to produce long-term, easily applied, nontoxic, nonmutilating marks. Two dyes, Pontamine Fast Pink BL and Solantine Turquoise G, were considered partially successful in that they lasted visibly for over nine months.

7179. Loeb, Howard A. (New York State Cons. Dept., Albany, New York). 1964. SOME NOTES CONCERNING THE TOXICITY OF ANTIMYCIN A TO CARP AND OTHER FISH. New York Fish and Game Journal, Vol. 11, No. 2, pp. 160-161.

Antimycin A was tested in an unsuccessful attempt to develop a poison bait for the selective control of carp. One limited but successful test with Antimycin A used as a contact poison was made in a quarter-acre pond containing carp, perch, and unidentified minnows.

7180. Atz, James W. (American Museum of Natural History, New York, N. Y.), and Grace E. Pickford. 1964. THE PITUITARY GLAND AND ITS RELATION TO THE REPRODUCTION OF FISHES IN NATURE AND IN CAPTIVITY. FAO Fisheries Technical Paper No. 37, 61 pp.

This annotated bibliography for the years 1956-1963 consists of a serially numbered list of references arranged in alphabetic order to authors' names, with author, subject and taxonomic indexes.

7181. Beverton, R. J. H., and S. J. Holt (Food and Agriculture Organization of the United Nations, Rome, Italy). 1964. TABLES OF YIELD FUNCTIONS FOR FISHERY ASSESSMENT. FAO Fisheries Technical Paper No. 38, 49 pp.

Tables of expressions are listed for use in assessing sustainable yields as functions of the fishing effort and size at first capture, for various values of the ratios of natural mortality to growth and to total mortality, and size of first capture to final size.

7182. Williams, G. R. (Div. of Fish. and Oceanog. of the Commonwealth Scientific and Industrial Research Organization, Australia). 1964. ORGANIZATION AND MANAGEMENT OF RESEARCH ON MARINE FISH RESOURCES. FAO Fisheries Technical Paper No. 43, 26 pp.

The organization and management of marine fish resources research is discussed under five main headings: Policy direction, research plan, operational procedures and controls, reporting results, and structure of the research organization. The appendix outlines an operational plan for a

survey of the prawn resources of the Gulf of Carpentaria.

7183. Food and Agriculture Organization of the United Nations (Fisheries Div., Biology Branch, Rome, Italy). 1964. FISH AND PESTICIDES: A GENERAL STATEMENT OF FAO POLICY. FAO Fisheries Technical Paper No. 45, 5 pp.

This document discusses the damage that may be caused to fish and other aquatic animal by pesticides. It describes action taken by the Organization with respect to use of pesticides and lists proposals by the FAO Fisheries Division concerning the use of pesticides and pesticide research with respect to fish.

7184. Pearcy, William G., and Charles L. Osterberg (Dept. Oceanog., Oregon State Univ., Corvallis). 1964. VERTICAL DISTRIBUTION OF RADIONUCLIDES AS MEASURED IN OCEANIC ANIMALS. Nature, Vol. 204, No. 4957, pp. 440-441.

Radioactivity/g of oceanic animals may demonstrate different patterns of depth distribution for different radioisotopes. Moreover, since zinc-65 is ubiquitous in marine animals off Oregon, vertical migrations of biomass will result in a vertical flux of radiozinc. The largest day-night changes in zinc-65/1,000 m^3 occurred across the depth of 150 m, a depth which corresponds approximately to the halocline and a rapid density change that impedes vertical mixing by physical processes in this portion of the Pacific Ocean. Further generalizations based on these limited data are obviously unwarranted, as little is known of temporal or spatial variations of these radionuclides associated with oceanic animals.

7185. Egglishaw, H. J. (Freshwater Fisheries Lab., Pitlochry, Perthshire, Scotland). 1964. THE DISTRIBUTIONAL RELATIONSHIP BETWEEN THE BOTTOM FAUNA AND PLANT DETRITUS IN STREAMS. The Journal of Animal Ecology, Vol. 33, No. 3, pp. 463-476.

Monthly samples, containing bottom fauna, plant detritus and inorganic matter, taken from the bed of a riffle in a stream, the Shelligan Burn, showed that the distribution of the bottom fauna was significantly correlated with the distribution of the plant detritus in the riffle.

The distributions of Leuctra inermis, Amphinemura sulcicollis, Baetis spp., Rhithrogena sp. and Chironomidae (together comprising almost 70% of the fauna collected) were closely correlated with the distribution of plant detritus in the riffle. The distribution of Chloroperla torrentium was usually random and not related to the distribution of plant detritus. The distributions of the larvae of Simulium spp. and Hydroptilidae were shown not to be related to the distribution of plant detritus.

Experimental evidence, from studying the aggregation of animals in trays, containing different amounts of plant detritus, set into the bed of the stream, showed that the similarity in the distribution patterns of the bottom fauna organisms and plant detritus in the riffle was not due solely to the operation of some external factor.

In another stream, Allt dos Mhuicarain, which was chemically poorer than the Shelligan Burn, there were far fewer animals but the amount of plant detritus present was at least equal to that in the Shelligan Burn. The regression of animals on plant detritus in the Shelligan Burn, was much greater than the regression in Allt dos Mhuicarain.

Insufficient variation of samples from the headwaters of the River Almond probably accounts for the relationship between the bottom fauna and plant detritus being demonstrated for only three of eight series of samples from this stream. (Auth. Summ.)

7186. King, Susan F. (Dept. Zool., Duke Univ., Durham, North Carolina). 1964. UPTAKE AND TRANSFER OF CESIUM-137 BY CHLAMYDOMONAS, DAPHNIA, AND BLUEGILL FINGERLINGS. Ecology, Vol. 45, No. 4, pp. 852-859.

Concentration factors of Cs-137 for Chlamydomonas moewusii, Daphnia pulex, D. magna, and Lepomis macrochirus fingerlings were determined following direct exposure to the isotope in solution and following ingestion of labeled food by the daphnids and fish. Cesium specific activity, temperature, and algal cell concentration were varied to determine effects on Cs-137 uptake. Uptake of Cs-137 by all organisms was less at 8° than at 22° C. Chlamydomonas uptake rose with increase of available cesium in the water up to 1.0 ppm and fell with increasing algal densities. Cesium uptake by D. pulex and D. magna differed. D. pulex uptake of Cs-137 increased but D. magna uptake was not affected when available labeled Chlamydomonas was increased. In direct uptake studies at 22° C, D. pulex concentrated three times the amount of Cs-137 concentrated by D. magna. Direct uptake of Cs-137 by L. macrochirus was negligible. Fingerlings showed increased uptake when allowed to feed for 24 hr on labeled daphnids.

Efficiency of removal of Cs-137 from ingested food was 21% for D. pulex; 13-14% for L. macrochirus, and 0.0% for D. magna.

In one food chain study at 22° C, Chlamydomonas, at 20 X 10^7 cells/liter, reached a 24 hr concentration factor of 319; D. pulex, after feeding on the labeled alga for three days, had a concentration factor of 354; and the striated muscle tissue of L. macrochirus, which had fed for one day on the labeled D. pulex, had a concentration factor of 7.8.

Rad dosages received by each species from Cs-137 decay in the water and organisms were calculated. Based on the concentration factors given in the above food chain study, Chlamydomonas received 0.11 rads/day, D. pulex 8.5 rads/day, and L. macrochirus muscle 0.38 rads/day. (Auth. Abst.)

7187. Kramer, James R. (Dept. of Geology and Mineralogy, Univ. of Michigan, Ann Arbor). 1964. SEA WATER: SATURATION WITH APATITES AND CARBONATES. Science, Vol. 146, No. 3644, pp.

637-638.

Pacific Ocean water, on the average, appears to be slightly supersaturated at all temperatures with hydroxyapatite and carbonate fluorapatite. Water above 14° C is saturated with calcite, whereas water above 20° C is saturated with aragonite. (Auth.)

7188. Ikuta, Kunio (Miyazaki Prefecture Coastal Fishery Guidance Station, Nobeoka City, Miyazaki, Japan). 1964. STUDIES ON THE MASSIVE DEATH OF AYU, PLECOGLOSSUS ALTIVELIS T. AND S., CAUSED BY THE WASTE OF PHENOL-FORMALDEHYDE RESIN WORKS. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 30, No. 8, pp. 601-609.

Since the end of 1961, mullets, eels, and crucian carp had died in the area polluted with the waste of phenol-formaldehyde resin works in Hori River, Nobeoka City, Miyazaki Prefecture. Near the outlet, the wastes of rayon works and carbon disulfide works are also ejected. The wastes of the latter two are treated by aeration, neutralization and sedimentation, while the waste of the phenol-formaldehyde resin works have never been treated. Therefore, it was surmised that the death of the fishes was due to the waste of the resin works. Then, the author investigated the water quality of the polluted area in Hori River, determining especially concentration of phenol in the water. The term on which the present investigation was carried out, particularly from March to May, was the season of upstream migration of Ayu, Plecoglossus altivelis.

At the outlet, the death of Ayu occurred frequently. Examining the results obtained, it seemed also that the death of Ayu and the other fishes at the lower reaches of Hori River was ascribable to the toxic effect of phenol and formalin within the waste from resin works. It is also found that the massive death of Ayu migrating upstream is more or less related to the tide. The stream of the river polluted with the wastes flows more gently at flood time than at ebb time, and stagnate at high water, and it leads to the death of the fish.

Using carp as materials, TLm determination was carried out in the laboratory. The lethal concentrations (TLm-48 hrs) were presented as follows:

phenol 25~27 ppm; formalin 0.063~0.066 0/00; mixture of the two 0.93 ppm (ph.) + 0.1023 0/00 (f.) - 1.02 ppm (ph.) + 0.1122 0/00 (f.).

The principal cause of death might possibly be a paralysis of the nervous system caused by nervous toxicity of phenol and formaldehyde. (Auth.)

7189. Holliday, F. G. T. (Natural History Dept., The University, Aberdeen, Scotland), J. H. S. Blaxter, and Ruben Lasker. 1964. OXYGEN UPTAKE OF DEVELOPING EGGS AND LARVAE OF THE HERRING (CLUPEA HARENGUS). Journal of the Marine Biological Association of the United Kingdom, Vol. 44, No. 3, pp. 711-723.

The oxygen uptake of eggs and larvae of Norwegian herring from Bergen (mean unfertilized egg dry weight about 0.35 mg) and of Baltic herring from Kiel (mean unfertilized egg dry weight about 0.10 mg) was measured by a reference diver and a Warburg respirometer. Anesthetized Kiel larvae had values of about 0.10 µl. /larva/h and Bergen larvae 0.25 µl. /larva/h. When expressed as Q_{O_2} (µl. /mg dry weight/h) the values became Kiel 2.3, Bergen 2.5.

Oxygen uptake of embryos before hatching and of larvae, expressed as Q_{O_2}, was most affected by activity, increasing in very active organisms by five to ten times the resting value of 1-2 µl./mg dry weight/h. Experiments to test the effects of temperature and salinity were done using anesthetized larvae in some cases.

Temperature experiments with larvae gave a Q_{10} of about 2, the Q_{O_2} of anesthetized Kiel larvae ranging from about 2.0 at 5° C to 3.5 at 14° C, and that of unanesthetized Bergen larvae from 2.5 at 6° C to 5.0 at 14° C.

Eggs and larvae of both races reared in salinities from 5 to 50 0/00 showed no detectable difference in oxygen uptake. However, abrupt transfer of anesthetized larvae from one salinity to another caused violent fluctuations (by up to ten times) before adaptation took place. Buoyancy differences appeared to mask differences in oxygen uptake of unanesthetized larvae in similar transfer experiments.

There was little tendency for oxygen uptake to become reduced during darkness in either Bergen or Kiel larvae.

The effect of age on oxygen uptake (expressed as Q_{O_2}) was not marked, though there tended to be a peak at, and just after, hatching, with a tendency for a fall off during starvation. (Auth. Summ.)

7190. Helle, John H., Richard S. Williamson, and Jack E. Bailey (Bur. Comm. Fish. Biol. Lab., Auke Bay, Alaska). 1964. INTERTIDAL ECOLOGY AND LIFE HISTORY OF PINK SALMON AT OLSEN CREEK, PRINCE WILLIAM SOUND, ALASKA. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 483, 26 pp.

Intertidal spawning of pink salmon is of major importance in Prince William Sound. Studies were initiated at Olsen Bay in 1960 to ascertain how much these intertidal spawners contributed to the total production of pink salmon.

Olsen Creek is inundated with tidewater about 80 percent of the time at the 3-foot tide level and about 7 percent of the time at the 11-foot level. Saline water was shown to penetrate the gravel at redd depth during high tides. The highest concentration at the 11-foot tide level was 9.3 0/00 during a 14.5-foot tide. Temperature changes of up to 10° F would occur within 1 hour at elevations up to the 8-foot level on floodtide.

The occurrence of spawners in 1960 and 1961 was bimodal; however, in 1960 the late run utilized only the intertidal spawning area, while in 1961 the late run utilized both the intertidal and fresh-water areas. During the 2 years the early run spawned in both environments. In 1960, 98,574 pink salmon spawned in Olsen Creek and in 1961, 135,905

spawned. During both years 74 percent of the total run spawned in the intertidal portion of the stream.

Temporal and spatial distribution of spawners, size differences, and seasonal changes in sex ratios provide evidence for the existence of discrete spawning groups or races.

Live egg densities and survival over winter to the preemergent fry stage were progressively greater from the lower to the higher levels in the intertidal area. Overwinter survival between egg and fry stages below the 4-foot level was 0. Survival at the 7- and 9-foot level and the 10- and 11-foot level was 20 and 54 percent respectively. (Auth. Abst.)

7191. Demory, Robert L., Russell F. Orrell, and Donald R. Heinle (Fisheries Research Inst., Univ. of Washington, Seattle). 1964. SPAWNING GROUND CATALOG OF THE KVICHAK RIVER SYSTEM, BRISTOL BAY, ALASKA. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 488, 292 pp.

Information about the red salmon runs and the spawning streams and beaches in the Kvichak River system, Bristol Bay, Alaska, is cataloged in this volume. The material is compiled from data obtained from spawning ground surveys made in the area since 1955.

For each spawning stream or beach, the catalog gives, whenever available, the stream catalog number, name, location, and physical description, including dimensions, bottom quality, flow, barriers, etc. Then a description of red salmon runs to the area is listed, including magnitude of the run and timing and distribution of spawning. Estimates of numbers of red salmon to each stream or beach are listed chronologically under a separate entry entitled "Summary of Surveys." (From Auth. Abst.)

7192. Allanson, B. R. (Dept. of Zoology and Entomology, Rhodes Univ., Grahamstown, South Africa), and R. G. Noble. 1964. THE TOLERANCE OF TILAPIA MOSSAMBICA (PETERS) TO HIGH TEMPERATURE. Transactions of the American Fisheries Society, Vol. 93, No. 4, pp. 323-332.

The median lethal temperatures for Tilapia mossambica (Peters) at different acclimation temperatures were estimated and the ultimate upper lethal temperature was found to lie between 38.20° C and 38.25° C. The effects of acclimation temperature and period of acclimation upon resistance were also investigated. An average acclimation rate of 1° per 150 minutes was estimated for fish transferred directly from 25° C to 30° C, whereas it was observed that fish transferred from 25° C to 15° C were not fully acclimated even after 20 days. These data confirm that T. mossambica is a thermophilic species. (Auth. Abst.)

7193. Donaldson, Lauren R., and Kelshaw Bonham (Lab. of Radiation Biology, Univ. of Washington, Seattle). 1964. EFFECTS OF LOW-LEVEL CHRONIC IRRADIATION OF CHINOOK AND COHO SALMON EGGS AND ALEVINS. Transactions of the American Fisheries Society, Vol. 93, No. 4, pp. 333-341.

Chinook and coho salmon eggs were subjected to about 0.5 roentgen per day of the gamma radiation from cobalt-60 from shortly after fertilization until the alevins swam, resulting in a total dose to the chinooks of from 33 to 37 roentgens and to the cohos of 40 roentgens. Irradiated, and similarly treated but unirradiated controls, were compared for survival, growth, vertebral numbers and anomalies, opercular defects, and sex ratios. Significant differences were observed only in the more frequent occurrence of opercular defects among irradiated than among control coho salmon smolt. In some phases of growth the controls and in others the irradiated groups showed superiority without a discernible pattern. As late as the time of release of the smolt for their seaward migration, little if any difference appeared between experimental and control groups. Differences will be sought in the F_1 generation from these fish. (Auth. Abst.)

7194. Shumway, Dean L., Charles E. Warren (Dept. of Fish and Game Mgmt., Oregon State Univ., Corvallis), and Peter Doudoroff. 1964. INFLUENCE OF OXYGEN CONCENTRATION AND WATER MOVEMENT ON THE GROWTH OF STEELHEAD TROUT AND COHO SALMON EMBRYOS. Transactions of the American Fisheries Society, Vol. 93, No. 4, pp. 342-356.

Embryos of coho salmon, Oncorhynchus kisutch (Walbaum), and steelhead trout, Salmo gairdneri gairdneri Richardson, were reared from fertilization of the eggs to hatching, at about 10° C, at different concentrations of dissolved oxygen ranging from about 2.5 to 11.5 mg/liter and at different water velocities ranging from about 3 to 750 cm/hr. Some of the embryos rested on porous plates, while others were buried in glass beads so as to simulate natural conditions more closely. Fry from embryos reared at low intermediate oxygen concentrations hatched later and were smaller in size at hatching than fry from embryos reared at concentrations near the air-saturation level. At all oxygen concentrations tested, reduced water velocities resulted in reduced size of hatching fry. This effect of velocity was nearly as pronounced at high oxygen concentrations as at low concentrations. The effect of the difference of water velocities tested was less than the effect of the difference of oxygen concentrations tested. When some embryos were buried in glass beads while others were not, and the discharge rates of water through cylinders containing the embryos were the same, the fry that hatched in the cylinders containing beads were larger in size than those in cylinders without beads. This effect is ascribed to the increase of water velocities around the embryos buried in beads. It was usually most pronounced when a mixture of large and small beads was used. (Auth. Abst.

7195. Jensen, Loren D., and Arden R. Gaufin (Dept. of Zoology and Entomology, Univ. of Utah, Salt Lake City). 1964. LONG-TERM EFFECTS

OF ORGANIC INSECTICIDES ON TWO SPECIES OF STONEFLY NAIADS. Transactions of the American Fisheries Society, Vol. 93, No. 4, pp. 357-363.

Two species of stonefly naiads, Acroneuria pacifica Banks and Pteronarcys californica Newport, were exposed to various organic insecticides for a period of thirty days in concentrations at or less than the 4-day TLm concentrations for each species. In general, the concentrations at or near the 4-day TLm concentrations were lethal to 50 percent of the specimens within 4 to 10 days of continuous exposure. Less concentrated solutions produced toxic symptoms after 10 to 14 days. With some insecticides these symptoms appeared only after 21 days of continuous exposure. Normal molting of the specimens was inhibited in the aquaria at or near the 4-day TLm concentrations. In lesser concentrations molting was not reduced until after 21 to 25 days of exposure, at which time marked reductions in molting rates were observed. (Auth. Abst.)

7196. Hoss, Donald E. (Bur. Comm. Fish., Radiobiological Lab., Beaufort, North Carolina). 1964. ACCUMULATION OF ZINC-65 BY FLOUNDER OF THE GENUS PARALICHTHYS. Transactions of the American Fisheries Society, Vol. 93, No. 4, pp. 364-368.

The amounts of zinc-65 accumulated from water and from food by flounder, Paralichthys sp., were measured and compared. When concentration factors were calculated, it was found that flounder concentrated zinc-65 to higher levels from food than from water. The initial rate of accumulation of zinc-65 from water was dependent on the concentration of the radionuclide in the water. Results of experiments reported indicate that the transfer of zinc-65 through the food chain is a more important pathway of accumulation for fish than direct accumulation from water. (Auth. Abst.)

7197. Paulik, G. J., and Lawrence E. Gales (Fish. Research Inst., Univ. of Washington, Seattle). 1964. ALLOMETRIC GROWTH AND THE BEVERTON AND HOLT YIELD EQUATION. Transactions of the American Fisheries Society, Vol. 93, No. 4, pp. 369-381.

In the development of their theory of fishing, Beverton and Holt assume that growth is isometric and thus express the body weight of a fish as directly proportional to the cube of its length. The effect on their theory of replacing this assumption with an allometric growth equation estimated from weight-length data is examined in this paper. Numerical evaluation of the Beta-integral that results from using allometric growth in the yield equation was carried out on a digital computer. Relative and absolute differences between the yield isopleths obtained using isometric growth and those obtained using allometric growth are examined for taxonomic groups with different characteristic growth patterns and longevities. (Auth. Abst.)

7198. Bailey, Merryll M. (Bur. Comm. Fish., Ashland, Wisconsin). 1964. AGE, GROWTH, MATURITY, AND SEX COMPOSITION OF THE AMERICAN SMELT, OSMERUS MORDAX (MITCHILL), OF WESTERN LAKE SUPERIOR. Transactions of the American Fisheries Society, Vol. 93, No. 4, pp. 382-395.

This study is based on 4,561 smelt collected in Chequamegon Bay, the Apostle Islands, the Brule River, and Superior Harbor, all in western Lake Superior. Commercial production in the Great Lakes (U. S. and Canada combined) reached a peak of nearly 16 million pounds in 1960. Production in Lake Superior has generally been small but increased during the 1950's to reach 948,000 pounds in 1960.

All 0-group and spring I-group smelt had scales with sufficient sculpturing to permit detection of the first annulus. Annulus formation began after June 6 in 1960. In 1961, all smelt had completed the annulus by August 24. The body-scale relation is a straight line with an intercept of -0.9 inch on the axis of fish length.

The weight of western Lake Superior smelt increased as the 2.952 power of the length. A large range of length in each age group and resulting overlap of age-groups II-VI made length a poor index of age. Female smelt grew faster than males after the second year and dominated strongly in age-groups IV-VII. Both sexes made their best annual growth in length (3.3 inches) during their second year of life; the largest weight increments (0.74 ounce, males; 0.85 ounce, females) came in the third year.

Best production from a commercial pound net in 1961 occurred when the sex ratios of spawning smelt were nearest 50:50. Spawning male smelt were consistently shorter than females and the average lengths of both sexes decreased as the spawning season progressed. Shortest mature smelt of each sex were 5.0 to 5.2 inches but the males are probably the first to reach 100 percent maturity. All year-old smelt were immature. Among 2-year-old fish, 40.7 percent of the males and 17.7 percent of the females had reached maturity. All smelt more than 2 years old were mature. Ovaries of 10 smelt contained an average of 31,338 eggs for fish 7.3 to 8.8 inches long. (Auth. Abst.)

7199. Lowe, Jack I. (U. S. Bur. Comm. Fish., Biol. Lab., Gulf Breeze, Florida). 1964. CHRONIC EXPOSURE OF SPOT, LEIOSTOMUS XANTHURUS, TO SUBLETHAL CONCENTRATIONS OF TOXAPHENE IN SEAWATER. Transactions of the American Fisheries Society, Vol. 93, No. 4, pp. 396-399.

During five months of exposure to sublethal concentrations of toxaphene, there was no significant difference in mortality among control and experimental fish. Acute toxicity tests conducted at the end of the experiment indicated that the treated fish appear to be even more sensitive to toxaphene than the control fish.

7200. Tarrant, Robert M., Jr. (U. S. Bur. Comm. Fish., Fish-Passage Research Program, Seattle, Washington). 1964. RATE OF EXTINCTION OF A

CONDITIONED RESPONSE IN JUVENILE SOCKEYE SALMON. Transactions of the American Fisheries Society, Vol. 93, No. 4, pp. 399-401.

Laboratory experiments indicate that the conditioned response in juvenile sockeye salmon is relatively stable.

7201. Parker, R. R., and L. Margolis (Fisheries Research Bd. of Canada, Biol. Sta., Nanaimo, B. C., Canada). 1964. A NEW SPECIES OF PARASITIC COPEPOD, CALIGUS CLEMENSI SP. NOV. (CALIGOIDA: CALIGIDAE), FROM PELAGIC FISHES IN THE COASTAL WATERS OF BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 873-889.

Adult females and males of Caligus clemensi sp. nov. from the body surface of British Columbia fishes are described. The known hosts are Oncorhynchus kisutch, O. gorbuscha, O. keta, Clupea pallasi, Gasterosteus aculeatus, Hexagrammos sp. and Theragra chalcogrammus. This is the only species of Caligus known from the coastal waters of British Columbia. "Caligus gurnardi Krøyer" of Fraser, 1920, is synonymous with the new species. (Auth. Abst.)

7202. Manzer, J. I. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C., Canada). 1964. PRELIMINARY OBSERVATIONS ON THE VERTICAL DISTRIBUTION OF PACIFIC SALMON (GENUS ONCORHYNCHUS) IN THE GULF OF ALASKA. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 891-903.

The vertical distribution of Pacific salmon in the high-seas areas of the Gulf of Alaska was investigated from mid May through July in 1959 and 1960 by fishing with gill nets (constructed from 4-1/2 inch nylon web and measuring 40 ft in depth and initially 400 fathoms in length) at five depth intervals from the surface with the deepest between 160 and 200 ft.

Sockeye salmon exhibited diurnal and seasonal differences in their vertical distribution while chum salmon showed diurnal differences. The downward movement of sockeye salmon appeared limited by the thermocline, especially during late June and July. This relationship was observed for chum salmon during hours of darkness only in late June and July. Other factors must also influence seasonal and diurnal vertical movements of sockeye and chum salmon. Within the conditions of the experiment, no consistent differences in the vertical migrations between fish of different age were apparent. Catches showed pink and coho salmon were nearer the surface than either sockeye or chum salmon. (Auth. Abst.)

7203. Ricker, W. E. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C., Canada). 1964. OCEAN GROWTH AND MORTALITY OF PINK AND CHUM SALMON. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 905-931.

Records of length of pink and chum salmon computed from scale annuli are summarized, and are converted to show rate of growth in weight. Information is available on 11 pink stocks or groups of stocks originating at points from the Strait of Georgia to Sakhalin and Primorye, and for 7 chum stocks taken from Tillamook Bay to the Amur River and Sakhalin. Estimates of increase in weight from the time of formation of the final annulus to time of capture near shore vary from 190% to 590% for pinks maturing at age 1+, and from 60% to 92% for chums maturing at age 3+. At the end of the first year, pinks are computed to average 356 g in weight, and chums 287 g. Average instantaneous rate of growth per month in the final year is 0.28 for pinks and 0.12 for chums, each available locality being given equal weight. The seasonal distribution of growth in the final year has been estimated for pink salmon of the Bering Sea (by Birman) and for those of the central British Columbia coast (by LeBrasseur and Parker); for chum salmon an approximate seasonal distribution can be deduced from comparisons of growth rates. Combining these with the best available estimate of natural mortality (0.02 per month for salmon more than 30 cm long), calculations of net yield from high-seas fishing can be made for any desired date, and compared with the yield from a purely coastal fishery (the same escapement being provided in both cases). In all situations the catch taken on the high seas is less than that taken from the survivors of the same fish in coastal waters. The loss of yield exceeds 50% for pinks taken early in their final season, and also for chums taken early in their penultimate season. (Auth. Abst.)

7204. Tully, John P. (Fish. Res. Bd. of Canada, Pacific Oceanographic Group, Nanaimo, B. C., Canada). 1964. OCEANOGRAPHIC REGIONS AND ASSESSMENT OF TEMPERATURE STRUCTURE IN THE SEASONAL ZONE OF THE NORTH PACIFIC OCEAN. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 941-970.

There are eight climatic regions from the Equator to the Arctic in the Pacific Ocean. In each region the distinct oceanographic temperature structures and their seasonal sequences are described and related to surface weather processes and transport. Procedures for observation and interpretation of data must be adapted to suit the regional models of structure and behavior. However, a rational universal system of information presentation is feasible and is demonstrated. The concepts may be extended to other oceans. (Auth. Abst.)

7205. Bond, Carl E., John D. Fortune, Jr., and Franklin Young (Dept. Fish & Game Mgmt., Oregon State Univ., Corvallis). 1965. RESULTS OF PRELIMINARY BIOASSAYS WITH KUROSAL SL AND DICAMBA. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 49-51.

Bioassays of the herbicides Kurosal SL and dicamba using juvenile salmonids as test animals indicated a broad margin of safety between concentrations

in use or under test for use as aquatic herbicides (2+5 ppm) and those toxic to the test fish. Median tolerance limits were estimated to be as follows: Kurosal SL for coho salmon (Oncorhynchus kisutch), 290 and 240 ppm for 24 and 48 hours; dicamba for coho salmon, 151 and 120. Juvenile rainbow trout (Salmo gairdneri) suffered no mortality to 320 ppm dicamba. (C. E. Bond)

7206. Lindsey, C. C. (Inst. of Fish., and Dept. of Zool., Univ. of British Columbia, Vancouver, B. C., Canada). 1964. PROBLEMS IN ZOOGEOGRAPHY OF THE LAKE TROUT, SALVELINUS NAMAYCUSH. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 977-994.

Disagreement exists in the literature as to whether lake trout survived Wisconsin glaciation north or south of the ice sheet. Other fresh-water fishes whose range in North America equals or exceeds that of lake trout all survived in both northern and southern refugia. Arguments in favor of a southern refugium for lake trout include their wide distribution eastward to Nova Scotia and New England, their presence in some Mississippi headwaters, and possible late-Wisconsin date of a fossil lake trout south of glaciation. Absence from some habitable lakes along the southern margin of glaciation is attributable to northward shift of isotherms during the hypsithermal period. A northern refugium is suggested by occurrence of lake trout in remote parts of Alaska, and the improbability of their having failed to reach and persist in Alaska prior to last glacial advance. They do not now closely approach Bering Strait, and may be held in check by ecological factors which have been operative also during previous glacial and interglacial periods, on the Bering land bridge as well as on the continent. Hucho taimen is a related Asian counterpart whose dispersal may be similarly controlled. Large lampreys may prevent dispersal of lake trout into lower water courses and the sea. (Auth. Abst.)

7207. McInerney, John E. (Zoological Laboratory, Dalhousie Univ., Halifax, Nova Scotia). 1964. SALINITY PREFERENCE: AN ORIENTATION MECHANISM IN SALMON MIGRATION. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 995-1018.

An examination of the modal salinity preferences of five Pacific salmon species showed the following pattern of temporal changes. The sequence began with a preference for fresh water, then changed gradually, in the direction of increasing sea-water concentration. The terminal pattern indicated a preference for water of open ocean concentration. This temporal progression of salinity preference changes was shown to parallel closely the salinity gradients typical of river outflows through which young salmon pass on their way to the ocean. On the basis of this evidence the following orientation mechanism was proposed: that juvenile Pacific salmon are able to use estuarial salinity gradients as one of the directive cues in their seaward migration. (Auth. Abst.)

7208. Parker, Robert R. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. ESTIMATION OF SEA MORTALITY RATES FOR THE 1960 BROOD-YEAR PINK SALMON OF HOOK NOSE CREEK, BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1019-1034.

Seaward migrating pink salmon fry at Hook Nose Creek, British Columbia, were estimated to total 1,153,000 in 1961. Of these, 41.5% or 479,000 were marked by amputation of both ventral fins (BV). Following this marking 36,900 fingerling were captured in the marine environment and marked by removal of the adipose and right ventral fins (ARV). During the 1962 fishing season 1,160,645 adult pinks were examined and 7050 BV and 184 ARV marks recognized. For the Hook Nose Creek stock, survival at sea from natural causes is shown to approximate 22% and the rate of exploitation was 95%. This stock is shown to be more exposed to fishing than the Bella Coola stock, for which a rate of exploitation of 69-80% is estimated. Rate of exploitation for Dean Channel stocks is even lower. These differences are explained as due to times of entry and rates of travel through the fishery. The two-stage marking experiment failed to estimate the natural mortality rate of juvenile pinks during the initial 5 weeks of sea life because of this dissimilarity between rates of exploitation on the stocks in the area. (Auth. Abst.)

7209. Scott, D. P. (Fish. Res. Bd. of Canada, Biol. Sta., London, Ontario). 1964. THERMAL RESISTANCE OF PIKE (ESOX LUCIUS L.), MUSKELLUNGE (E. MASQUINONGY MITCHILL), AND THEIR F_1 HYBRID. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1043-1049.

Comparison of thermal resistances of pike, muskellunge, and their F_1 hybrid indicates close similarity between the two species. There appears to be some hybrid vigor in that the hybrids tend to be more resistant to thermal stress at the average acclimation and test temperatures encountered in the experiments. The greatest difference between the hybrids and parents occurred at the lowest test temperatures. Differences between the parent species were apparent only in their response to acclimation temperature, the slope of the curve of resistance time on acclimation temperature being much steeper for muskellunge than that for pike. (Auth. Abst.)

7210. Ketchen, K. S. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. PRELIMINARY RESULTS OF STUDIES ON GROWTH AND MORTALITY OF PACIFIC COD (GADUS MACROCEPHALUS) IN HECATE STRAIT, BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1051-1067.

Preliminary results of tagging suggest that the Brody-Bertalanffy growth coefficient, K, of cod in northern Hecate Strait is 0.27 and the asymptotic length, L_∞, is 94.0 cm. Life span is relatively short and the fishery appears to be dependent

on fish which have completed 3 and 4 years of growth. Estimates of present day instantaneous total mortality rate, based on average length of fish in the catch, range from 1.05 to 1.53 (65-78% on an annual basis) depending on fishing area and length at full recruitment. Mortality rates of 0.83 and 0.99, computed from primitive length composition, may indicate the order of magnitude of the instantaneous natural mortality rate (56 and 63% expressed as an annual rate). (Auth. Abst.)

7211. Pfeiffer, Wolfgang, and T. F. Pletcher (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. CLUB CELLS AND GRANULAR CELLS IN THE SKIN OF LAMPREY. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1083-1088.

The club and granular cells in the skin of the lamprey appear to be two forms of the same cell, with the club cells developing into granular cells. Granular cells discharge their content on the surface of the skin. Granular and club cells do not contain mucus. Lampreys and their larvae are rarely found in stomachs of salmonids or other fish, and feeding experiments show that many fish will not eat lampreys and ammocoetes. A distasteful secretion from the granular cells of the skin is suspected of being biologically significant in protecting the lamprey from predacious fish. (Auth. Abst.)

7212. Nicol, J. A. C. (Marine Biol. Lab., Plymouth, England). 1964. REFLECTIVITY OF THE CHORIOIDAL TAPETA OF SELACHIANS. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1089-1100.

The reflecting layer or chorioidal tapetum in the eye of many selachians was examined to determine, especially, whether it is a set feature or whether it can be occluded.

Many selachians have a tapetum under the entire fundus of the eye. It consists of highly reflecting cells, towards the outer ends of which there is a layer of melanophores. In active pelagic sharks of the neritic zone (e. g. Squalus, Mustelus), the melanophores send out pigment over the reflecting cells so as to conceal them when the fish is illuminated; the pigment retreats in darkness. In benthic species of the neritic zone, notably Scyliorhinus, the fundus has a black ventral area; a tapetum occurs elsewhere and is not occlusible. The eyes of rays have a black ventral field, and pigment migration over the tapetum is slight. The tapetum is not occlusible in deep-sea squaloids and a chimaerid Hydrolagus affinis.

Reflectivity of the dark-adapted tapetum of Squalus acanthias amounts to about 85%. Full expansion of pigment in the light and retreat in darkness occupy about 2 hr in this fish.

Pieces of tapeta, freed of retinae, were mounted in Ringer solution, observed, and photographed by oblique illumination from above. The tapetal pigment migrates inwards over the reflecting plates in such preparations of tapeta from fishes that have occlusible tapeta.

The suggestion is offered that the tapetum is concealed, either by closure of the pupil or by migration of pigment, so as to avoid displaying eyeshine. Deep-sea squaloids, living in dimly lit environments, do neither. (Auth. Abst.)

7213. LeBrasseur, R. J., and R. R. Parker (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. GROWTH RATE OF CENTRAL BRITISH COLUMBIA PINK SALMON (ONCORHYNCHUS GORBUSCHA). Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1101-1128.

Pink salmon were sampled at various stages, as fry and fingerling in enclosed waters, as juveniles and subadults in the ocean and as maturing salmon in the commercial fishery. On the basis of length frequency data and from recapture measurements of marked and tagged individuals the instantaneous growth rate in length (g_l) for successive 30-day periods was computed. As a result three major growth stanzas were recognized. Following the entrance of fry into the estuary, growth was approximately exponential ($g_l = 0.559$) during an initial 40-day period. Fish increased in length from 3.5 to 8.4 cm. Thereafter, the instantaneous rate of growth gradually declined to a minimum in March ($g_l = 0.076$). During this time the length increased from 8.4 to 32.5 cm. The final growth period was marked by a rapid rate of increase in length in late April and early May ($g_l = 0.171$), followed by a declining rate of increase in length which was finally terminated after the fish had re-entered the coastal waters and the commercial fishery ($g_l = 0.041$). The length data were transformed to weight data from a generalized length-weight regression. During the initial 30-day period the instantaneous growth rate in weight, $g_w = 6.53$. From a value of $g_w = 2.87$ for late May and early June the instantaneous growth rate progressively fell to a low of $g_w = 1.28$ for late March to early April. During late April to early May of the ultimate year, $g_w = 1.74$. The instantaneous growth rate then fell to $g_w = 1.14$ during mid July to early August. It was concluded that growth, in length and weight, of central British Columbia pink salmon is a continuing process with no period of complete cessation from the time the fry enter the sea until the time they re-enter the estuary as adults. (Auth. Abst.)

7214. Hubbs, Carl L. (Scripps Inst. of Oceanog., La Jolla, California), and Norman J. Wilimovsky. 1964. DISTRIBUTION AND SYNONYMY IN THE PACIFIC OCEAN, AND VARIATION, OF THE GREENLAND HALIBUT, REINHARDTIUS HIPPOGLOSSOIDES (WALBAUM). Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1129-1154.

Long known in the Pacific Ocean from a single specimen from east-central Japan, the very distinctive flatfish genus Reinhardtius has been shown since 1930 to maintain a population of commercial significance from northern Japan to northwestern Bering Sea. It is now found to be common also in eastern Bering Sea, and to occur also just south of the tip of the Alaska Peninsula, in northern and

central California, and even at the extreme north of Baja California, Mexico. Japan and the Californians appear to be inhabited by nonbreeding expatriates, whose wanderings are attributable to the free-swimming habits and prolonged early pelagic development of the species. Lack of records between the Alaska Peninsula and California may possibly indicate actual absence, attributable to current pattern. Analysis of the only morphometric characters thought to be indicative of subspecific differentiation between the Pacific and Atlantic stocks discloses no basis for such separation, nor do any meristic characters disclose such a basis. The single species Reinhardtius hippoglossoides is, therefore, regarded as a uniquely undifferentiated amphiboreal taxon. The chief distinction between the ocean stocks lies in the number of vertebrae, but the differentiation (probably genetic) is not beyond the racial level. The difference in vertebral numbers, surprisingly, is not paralleled by a difference in numbers of dorsal or anal rays; nor is there any marked correlation between vertebral and ray numbers. As expected, the numbers of dorsal and anal rays are found to be positively correlated, and the number of precaudal and caudal vertebrae to be negatively correlated. In this flatfish of relatively limited asymmetry the numbers of rays are virtually identical in the two pectoral fins. Two reversed examples of the species are reported. (Auth. Abst.)

7215. Brett, J. R. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. THE RESPIRATORY METABOLISM AND SWIMMING PERFORMANCE OF YOUNG SOCKEYE SALMON. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1183-1226.

The rate of oxygen consumption in young sockeye salmon (Oncorhynchus nerka) was determined for various swimming speeds, including fatigue levels, at temperatures of 5, 10, 15, 20, and 24° C. A logarithmic increase in oxygen demand with increase in swimming speed characterized each acclimation temperature. Extrapolation to zero activity (standard metabolism) and maximum activity (active metabolism) provided differences of the order of 10 to 12 times the minimum rate.

The greatest scope for activity occurred at 15° C with an average active metabolic rate of 895 mg O_2/kg/hr for a swimming speed of 4.1 body lengths per second, just maintained for 1 hr. Above 15° C active metabolism was limited, apparently by oxygen availability.

Rate of replacement of oxygen debt following fatigue was determined by tracing the return to a resting state of metabolism, and confirmed by re-tests at fatigue velocities. In most instances the rate declined logarithmically with time; in some there was an initial or secondary slump. Times to recovery (return of spontaneous activity) averaged 3.2 hr, independent of acclimation temperature.

Swimming speed-fatigue tests indicated a sustained level of performance at about 200-300 min. Comparison with other fish suggests a marked change in slope of the fatigue curve at about 20 sec. The effect of temperature was greatest on sustained speeds and least on burst speeds. (Auth. Abst.)

7216. Neave, Ferris (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. OCEAN MIGRATIONS OF PACIFIC SALMON. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1227-1244.

Sockeye salmon (Oncorhynchus nerka), pink salmon (O. gorbuscha), and chum salmon (O. keta) commonly return to their places of origin from distant high-seas areas. Maturing fish closely associated at high-seas localities travel in many different directions to their respective destinations. They also travel from many different high-seas localities to a common coastal area. Prior to their return to inshore waters, pink salmon perform ocean journeys which are associated with changes in temperature and which do not necessarily represent a direct approach to a spawning area. The ocean journeys of both juvenile and maturing salmon are largely independent of currents. Homing is not thought to be commonly accomplished by random or near-random ocean travel or by extensive searching of coastlines. It is suggested that ability to set a compass course, using a celestial feature, is insufficient to account for the indicated performance and that some form of bico-ordinate navigation may be required. (Auth. Abst.)

7217. Bilton, H. T., D. W. Jenkinson, and M. P. Shepard (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. A KEY TO FIVE SPECIES OF PACIFIC SALMON (GENUS ONCORHYNCHUS) BASED ON SCALE CHARACTERS. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1267-1288.

A key based on differences in scale structure was derived to separate the five North American species of Pacific salmon. For maturing individuals the key was effective in identifying precisely to species 100% of the sockeye (Oncorhynchus nerka), over 95% of the pinks (O. gorbuscha), over 90% of the chums (O. keta) and of the chinooks (O. tshawytscha), and between 14 and 67% of the coho (O. kisutch) examined. In all but a few of the remaining cases (in which the exact species could not be identified), the specimens were designated correctly as being one of two or three species. Only a few misclassifications (20 of the 3035 individuals examined) occurred. For sockeye the power of separation of the key for fish with only one ocean annulus was about the same as that for the matures but its ability to identify precisely chums and chinooks was lower. (Auth. Abst.)

7218. Larkin, P. A., and A. S. Hourston (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. A MODEL FOR SIMULATION OF THE POPULATION BIOLOGY OF PACIFIC SALMON. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1245-1265.

A model simulating the population dynamics of

the stocks of salmon spawning in a large river system is constructed, incorporating (1) a series of theoretical reproduction curves operating in successive stages during the life history of each stock producing compensatory or depensatory effects, (2) a device for simulating environmental variability (extrapensatory effects), (3) the effects of a joint fishery on mixed stocks, (4) the effects of multiple age of spawning on fluctuations in abundance of a single stock, (5) the consequences to yield of various degrees of stabilization of the fishery, and (6) the inheritance of age at maturity in salmon. Application of the model is illustrated by two examples. The first simulates the production of cyclic dominance by the inheritance of age of maturity and depensation of the fresh-water stage. In the second example, five stocks differing in relative abundance, age composition, environmental variability, and rate of compensation are subjected to a common fishery which is selective for age and provides for complete stabilization of the escapement for the combined run as a whole. Comparisons between various combinations of the five stocks show the effects of these factors on the various stocks and on the run as a whole over a simulated period of 120 years. (Auth. Abst.)

7219. Waldichuk, Michael (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. DISPERSION OF KRAFT-MILL EFFLUENT FROM A SUBMARINE DIFFUSER IN STUART CHANNEL, BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1289-1316.

Stuart Channel is a stratified, estuarine region typical of British Columbia coastal "inside" waters. Tidal currents are mostly less than 1 kt at all depths, and set to the northwest on the flood and southeast on the ebb, along the axis of the channel. Effluent released by a submarine diffuser, from the kraft pulp mill at Crofton, mixes in a ratio of about 1:22 with sea water as it rises to the surface. The entrainment of cold, saline water in the ascent gives the effluent--sea-water mixture at the "boil" above the diffuser a density usually greater than that of surface sea water. Therefore, the mixture generally sinks and spreads in a thin sheet at a depth between 3 and 10 m. Non-tidal currents at the surface and at 9-10 m depth could be expected to give the effluent present in these layers a net displacement seaward through Sansum Narrows. Effluent at a depth of 4-5 m would receive a net transport in the opposite direction (northwest) and could be expected to be retained in the channel much longer. (Auth. Abst.)

7220. Outram, D. N., and F. H. C. Taylor (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. A QUANTITATIVE ESTIMATE OF THE NUMBER OF PACIFIC HERRING IN A SPAWNING POPULATION. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1317-1319.

7221. Sparrow, R. A. H. (Fish and Game Branch, British Columbia Dept. of Recreation and Conservation, Cranbrook, B. C.), P. A. Larkin, and R. A. Rutherglen. 1964. SUCCESSFUL INTRODUCTION OF MYSIS RELICTA LOVÉN INTO KOOTENAY LAKE, BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1325-1327.

7222. Shepard, M. P., F. C. Withler, J. McDonald, and K. V. Aro (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C.). 1964. FURTHER INFORMATION ON SPAWNING STOCK SIZE AND RESULTANT PRODUCTION FOR SKEENA SOCKEYE. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1329-1331.

7223. McAllister, D. E. (National Museum of Canada, Ottawa, Ontario). 1964. DISTINGUISHING CHARACTERS FOR THE SCULPINS COTTUS BAIRDII AND C. COGNATUS IN EASTERN CANADA. Journal of the Fisheries Research Board of Canada, Vol. 21, No. 5, pp. 1339-1342.

7224. Calaprice, John R., and John E. Cushing. 1964. ERYTHROCYTE ANTIGENS OF CALIFORNIA TROUTS. California Fish and Game, Vol. 50, No. 3, pp. 152-157.

The erythrocyte antigens of rainbow, golden, brown, and cutthroat trout were studied. These trout displayed a high degree of antigenic diversity useful for characterizing species, strains, and individuals. Such diversity forms recognizable markers that could be used to advantage in a number of studies related to the biology and management of California trouts. (Auth.)

7225. McCammon, George W. (Calif. Fish and Game, 722 Capitol Ave., Sacramento), Don La Faunce, and Charles M. Seeley. 1964. OBSERVATIONS ON THE FOOD OF FINGERLING LARGEMOUTH BASS IN CLEAR LAKE, LAKE COUNTY, CALIFORNIA. Calif. Fish and Game, Vol. 50, No. 3, pp. 158-169.

Stomachs of fingerling largemouth bass (2.1 to 3.6 inches mean total length) were examined for food during the three years 1956-1958. In all cases, fish were the most important food by volume, ranging from 56 percent in 1956 to 99 percent in 1958. A definite change in food preference, from crustaceans and insects to fish, took place with increasing size. It was also found that bass as small as 2.0 inches long were able to utilize suitable forage fish. (Authors)

7226. McConnell, William J. (4950 E. Towner, Tucson, Arizona), and John H. Gerdes. 1964. THREADFIN SHAD, DOROSOMA PETENENSE, AS FOOD OF YEARLING CENTRARCHIDS. Calif. Fish and Game, Vol. 50, No. 3, pp. 170-175.

During a 3-year study at Pena Blanca Lake, Santa Cruz County, Arizona, threadfin shad "failed" to provide adequate forage for yearling largemouth bass and black crappie. In volume, threadfin shad averaged 33 percent of the bass

diet and 17 percent of the crappie diet during these years. Arthropods, mainly cladocerans and insects, made up the remainder of the diet. (Authors)

7227. Turner, Charles H., Earl E. Ebert, and Robert R. Given. 1964. AN ECOLOGICAL SURVEY OF A MARINE ENVIRONMENT PRIOR TO INSTALLATION OF A SUBMARINE OUTFALL. Calif. Fish and Game, Vol. 50, No. 3, pp. 176-188.

During May and June 1962, an area offshore from Canyon de las Encinas was surveyed by biologists, utilizing SCUBA, to determine its ecology prior to installation of a submarine outfall. Transects were traversed to depths of 100 feet at four localities along a 2-1/4 mile stretch of beach. Physical conditions were noted, as well as the geology and topography of the bottom. All plant and animal occurrences were recorded and samples of unrecognized forms were collected for laboratory identification. Photographs were taken in many areas to document observations and for making comparisons of conditions after the outfall is constructed and placed in use. (Authors)

7228. Fitch, John E., and William L. Craig. 1964. FIRST RECORDS FOR THE BIGEYE THRESHER (ALOPIAS SUPERCILIOSUS) AND SLENDER TUNA (ALLOTHUNNUS FALLAI) FROM CALIFORNIA, WITH NOTES ON EASTERN PACIFIC SCOMBRID OTOLITHS. Calif. Fish and Game, Vol. 50, No. 3, pp. 195-206.

A bigeye thresher (shark) netted off San Clemente in July 1963, and a slender tuna netted in the inner Los Angeles Harbor in November 1963, represented first records for these species from the eastern Pacific Ocean. The otoliths (ear stones) of the slender tuna were compared with otoliths from other tuna-like fishes in an effort to determine its relationships. Otoliths for eight genera of tuna-like fishes are illustrated, and information is given on ways to distinguish each of the eight.

7229. Schott, Jack W. 1964. CHROMATIC PATTERNS OF THE LEOPARD SHARK, TRIAKIS SEMIFASCIATA GIRARD. Calif. Fish and Game, Vol. 50, No. 3, pp. 207-214.

The primary chromatic pattern of this shark consists of blackish saddle marks, mid-dorsal intersaddle marks, and inferior intersaddle marks on a light background. Frequency of occurrence of these markings was plotted for 47 specimens from throughout the shark's range. Secondary chromatic marks which appear on specimens longer than 737 mm, probably are related to sexual maturity. Two anomalously marked specimens are illustrated and discussed. (Auth.)

7230. Albrecht, Arnold B. 1964. CALIFORNIA STRIPED BASS ESTIMATES FOR 1961. Calif. Fish and Game, Vol. 50, No. 3, pp. 215-216.

Postcard questionnaires were mailed to 10,364 licensed anglers to determine the striped bass catch during 1961. About 32 percent of these anglers returned usable cards (representing 0.22 percent of the State's licensed anglers), and from these it was estimated the 1961 catch of striped bass 2.5 million fish (0.8 per angler day). The exaggeration and reliability of these estimates are not known. (Auth.)

7231. Bell, Robert R. 1964. WEIGHT-LENGTH RELATIONSHIP FOR BLUEFIN TUNA IN THE CALIFORNIA FISHERY, 1963. Calif. Fish and Game, Vol. 50, No. 3, pp. 216-218.

A table of weights by length (1 cm interval) is given for bluefin tuna from 50 cm (6.90 pounds) to 244 cm (574.73 pounds) long.

7232. Alverson, Franklin G., and Bruce M. Chatwin. 1964. 1916, THE PIONEER YEAR OF TUNA TAGGING ON THE PACIFIC COAST OF NORTH AMERICA. Calif. Fish and Game, Vol. 50, No. 3, pp. 218-219.

Records were turned up showing that 27 tuna (5 yellowfin and 22 albacore) were tagged in 1916 by U. S. Bureau of Fisheries personnel. One tag (from an albacore) was subsequently recovered about 400 miles upcoast from the release area. (Authors)

7233. Odemar, Melvyn W. (Calif. Dept. Fish and Game, Menlo Park). 1964. NORTHERN RANGE EXTENSION OF THE COW ROCKFISH, SEBASTODES LEVIS. Calif. Fish and Game, Vol. 50, No. 4, p. 305.

The known northern range of S. levis has been moved some 345 miles from Monterey, California, to Usal, California (lat. 39° 49' N., long. 123° 58' W.). A juvenile male S. levis was captured May 11, 1959, in 76 fathoms off Fort Bragg by a commercial shrimp boat, and on September 19, 1963, a juvenile was captured off Usal in 72 fathoms by the California Department of Fish and Game research vessel N. B. Scofield. (Auth.)

7234. Goodson, Lee F., Jr. (Calif. Dept. Fish and Game, Sacramento). 1964. DIET OF STRIPED BASS AT MILLERTON LAKE, CALIFORNIA. Calif. Fish and Game, Vol. 50, No. 4, p. 307.

Eight- to 34-inch striped bass, Roccus saxatilis, captured from April through November, fed almost exclusively on threadfin shad, Dorosoma petenense. (Auth.)

7235. La Faunce, Don A., J. B. Kimsey, and Harold K. Chadwick (Calif. Dept. Fish and Game, Sacramento). 1964. THE FISHERY AT SUTHERLAND RESERVOIR, SAN DIEGO COUNTY, CALIF. Calif. Fish and Game, Vol. 50, No. 4, pp. 271-291.

This is a warm-water reservoir completed in 1953. The paper describes the fishery from its inception in 1955 through 1960. Fishing was usually permitted on weekends, holidays and Wednesdays from about the beginning of May to early September. Angling pressure, success, and total catch increased throughout the study and all were greatest in 1960. Green sunfish, Lepomis cyanellus, dominated the catch in 1955 and 1956, but declined

drastically after this, probably because of competition with largemouth bass, Micropterus salmoides. Bluegill, Lepomis macrochirus, were introduced in late 1956 and dominated the catch in 1959 and 1960. Largemouth bass year-class size and growth rate fluctuated considerably, but age I and II bass dominated the catch except in 1957. The bass catch increased steadily through the period despite a 0.7 total mortality rate. The exploitation rate averaged about 0.4 from 1957 through 1959. The catch per hour for largemouth bass by all anglers during the first 10 days of each season was not a reliable index of population size. This was probably due mostly to changes in the type of anglers associated with the changing species composition of the catch, and to short-term differences in vulnerability associated with angling conditions. (H. K. Chadwick)

7236. Collier, Ralph S. (Shark Res. Comm., Inc., Van Nuys, California). 1964. REPORT ON A RECENT SHARK ATTACK OFF SAN FRANCISCO, CALIFORNIA. Calif. Fish and Game, Vol. 50, No. 4, pp. 261-264.

A great white shark (Carcharodon carcharias) attacked a skindiver at the Farallon Islands in January 1964. After an initial "bite" and subsequent harassment for several minutes, the shark moved off and threatened other members of the party. The victim suffered extensive damage to both legs below the hips, but recovery was complete after rescue, surgery, and postoperative care. (J. F.)

7237. Gotshall, Daniel W. (Calif. Dept. Fish and Game, Menlo Park). 1964. INCREASING TAGGED ROCKFISH (GENUS SEBASTODES) SURVIVAL BY DEFLATING THE SWIM BLADDER. Calif. Fish and Game, Vol. 50, No. 4, pp. 253-260.

Blue rockfish (Sebastodes mystinus) swim bladders were successfully deflated in tagging operations. Fish, distended by expanded gases, would not have been able to return to depths from which taken. Excess gas was released from swim bladders by using 18-gauge hypodermic needles, and tags were then applied to the fish. In some cases, these deflated fish were recaptured at a later date. A slightly higher percentage of tagged, non-deflated blue rockfish was recovered than deflated fish. Several other rockfish were also deflated successfully. In some cases, "popped eyes" were deflated too. (Auth.)

7238. Cuinat, Robin (Ingénieur Agricole, Chef de Travaux à la Station d'Hydrobiologie Appliquée de Biarritz, France). 1963. UN RISQUE DE SOUS-ESTIMATION DANS LES INVENTAIRES DE POPULATIONS EN RIVIÈRES A TRUITES. Bulletin du Centre d' Études et de Recherches Scientifiques, Biarritz, Vol. 4, No. 3, pp. 301-306.

Population censuses in trout rivers, by marking and recapture, often result in underevaluations. In fact, the differences of catchability which exist between trout of similar size groups and the attachment of these fishes (territoriality) to parts of the habitat more or less difficult to work bring about the result that the fish already taken and marked have a tendency to be found in larger quantities than the others in the second fishing sample. (Auth. Abst.) (French with English Abst.)

7239. Cuinat, Robin (Ingénieur Agricole, Chef de Travaux à la Station d'Hydrobiologie Appliquée de Biarritz). 1963. ÉVALUATION DES REPRISES DE POISSONS MARQUÉS NON DÉCLARÉES PAR LES PÊCHEURS. Bulletin du Centre d' Études et de Recherches Scientifiques, Biarritz, Vol. 4, No. 4, pp. 369-373.

It is known that fishermen do not declare all the tagged fish they recapture. To determine the "rate of declaration" and the actual number of recaptured fish, creel censuses can be made in a tagging area. A simple calculation permits the estimation of: (1) the "declaration rate" of the fishermen; (2) the "control rate" of the investigator; and (3) the actual number of recaptured fish. The results obtained in the census area give the corrections that have to be applied to the declared recaptures from the entire study area. (Auth. Abst.) (French with English Abst.)

7240. Cuinat, Robin (Ingénieur Agricole, Chef de Travaux à la Station d'Hydrobiologie Appliquée de Biarritz, France). 1963. UN NOUVEL APPAREIL DE PÊCHE ELECTRIQUE UTILISABLE DANS PRESQUE TOUTES LES EAUX CONTINENTALES. Bulletin Francais de Pisciculture No. 208, pp. 85-95.

Most standard electro-fishing apparatus with direct current can have good efficiency only in a short range of external resistances; several apparatus are therefore necessary to be able to fish efficiently in all trout waters in France.

The apparatus "Electro-Pullman puissant" No. 1 (EPP 1) described in this paper, is fitted with two special dynamos which can be connected in series or in parallel, thus giving the possibility of efficient fishing in streams of very different resistivity, on granitic soils as well as on very chalky soils, and of using simultaneously 1 to 4 positive electrodes. It is possible to fish with external resistances ranging from about 13 to 1.000 ohms, in streams of 20 to 30 meters wide. Maximum power provided: 4 kW, for a weight of 120 kg. (Auth. Abst.) (French with English Abst.)

7241. Cuinat, Robin, and Jacques Casaubon (Station d'Hydrobiologie Appliquée de Biarritz, France). 1963. RÉSULTATS DES DÉVERSEMENTS DE TRUITES D'ÉLEVAGE MARQUEÉS DANS QUELQUES RIVIÈRES DU PUY-DE-DÔME, DE 1958 A 1960. Bulletin Francais de Pisciculture Nos. 209-210, pp. 1-46.

From 1958 to 1960, 8.000 hatchery trout (most of them brown trout, Salmo trutta fario L., of legal size) have been tagged before being planted in some rivers of Puy-de-Dôme. For

each river, the results (recapture rate, growth rate, movements, rentability) are examined. The recapture rate is 6.7 percent on the average (15 percent in small rivers, 3 percent in deep and wide rivers). The catches are made mainly during the first days of the fishing period. One year after planting, none of these trouts are found in the course of control by electro-fishing. We can see some migrations to the sea. (Auth. Abst.) (French with English Abst.)

7242. Cuinat, Robin, and R. Vibert (Station d'Hydrobiologie Appliquée, Biarritz, France). 1963. DEMOGRAPHIC DIAGNOSIS ON FISH POPULATIONS IN TROUT STREAMS. General Fisheries Council for the Mediterranean, Studies and Reviews, No. 21, F. A. O., Rome, 26 pp.

The following simple and abridged study of population dynamics qualified here as "demographic diagnosis" could perhaps be used as an objective basis for trout stream management, or at least for the management of a certain number of standard pilot-rivers. An example of demographic diagnosis is given together with working techniques and corresponding calculations. (Auth. Abst.)

7243. Thomas, Allan E., Roger E. Burrows, and Harry H. Chenoweth (Salmon-Cultural Laboratory, Bur. Sport Fisheries and Wildlife, Longview, Washington). 1964. A DEVICE FOR STAMINA MEASUREMENT OF FINGERLING SALMONIDS. U. S. Fish and Wildlife Service, Research Report 67, 15 pp.

A stamina tunnel was developed to measure differences in physical performance of salmonid fingerlings. By subjecting fish samples to controlled patterns of water velocity, it has proved possible to demonstrate differences in fish stamina imparted by disease, nutrition, and environment. (Auth. Abst.)

7244. Kruse, Paul J., Jr. (Bur. Comm. Fish. Exploratory Fishing and Gear Research Base, Pascagoula, Miss.). 1964. A REMOTE CONTROLLED UNDERWATER PHOTOGRAPHIC SURVEILLANCE SYSTEM. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 490, 16 pp.

An underwater motion picture camera system has been developed and used to study midwater trawling operations. The photographic equipment is handled by remote control from the vessel deck and records both trawl mechanics and fish escape reactions. The equipment has been tested and placed in operation in studies in the Gulf of Mexico. (Auth. Abst.)

7245. Watson, L. J. (S. Illinois Univ., Dept. Microbiol., Carbondale), I. L. Shechmeister, and L. L. Jackson. 1963. THE EFFECT OF X-IRRADIATION ON GOLDFISH. II. THE EFFECT OF TOTAL-BODY X-IRRADIATION ON THE HEMATOLOGY OF CARASSIUS AURATUS. Physiol. Zool. 36(4): 370-382; Biological Abstracts, Vol. 45, No. 6, Abst. No. 22865. 1964.

Goldfish were exposed to 100 to 5000 r. Blood counts were analyzed periodically during the 60-day postirradiation period. A sharp depression of all leukocyte elements occurred within 24 hours. Thirty to 60 days after irradiation a slight recovery in the WBC population was observed in animals exposed to 100 r. All peripheral granulocytic blood cells increased briefly during the first 7 hours after exposure to 1000 r and 2000 r. The increase in lymphocytes was not as great as that observed among the granulocytes. In the erythrocyte population poikilocytosis and increase in cellular fragility was seen. Exposure of goldfish to 1000 r decreased the number of thrombocytes and increased coagulation time. Seven days after exposure to 1000 r and 2000 r a bacterial fish pathogen, Aeromonas salmonicida, was injected intraperitoneally. The increased susceptibility of C. auratus to the experimental infections following irradiation was attributed to pancytopenia and a decrease in phagocytic activity in lesions at the site of inoculation of irradiated infected animals. (Authors)

7246. Aslanova, N. E. 1961. A STUDY OF THE REACTION OF FISH TO NET WEBBING. (IZUCHENIE REAKTSII RYB NA SETNOE POLOTNO.) Tr. Vses. Nauchn.-Issled. Inst. Morsk. Rybn. Khoz. i Okeanog. 44: 165-176; Referat. Zhur., Biol., 1963, No. 13I57; Biological Abstracts, Vol. 45, No. 6, Abst. No. 22973. 1964.

Results of experiments on reflex actions of fish on meeting net webbing are reported. Experiments were performed with Leucaspius delineatus, a diurnal, aggregative fish, with a high tolerance of aquarium conditions. Experiments were conducted with hungry fish at the time of feeding, and also with fed fish. Reflexes were elicited in the presence of white and brown nets with meshes of 5 and 16 mm. Three groups of fish (145, 10, 2 specimens) took part in each experiment. With the exception of fishes which were foraging during their spawning period, all other fishes exhibited a defensive reaction on meeting net webbing. After a certain interval of time the fishes become adapted to the net. Adaptation to brown webbing occurred more rapidly in young fish browsing in a shoal (145 specimens).

7247. Kuderskii, L. A., and V. M. Erastova (Karel'sk Fil. Acad. Sci. USSR, Petrozavodsk, USSR). 1962. MATERIALS ON THE FEEDING OF THE WHITE SEA WHITEFISH (COREGONUS LAVARETUS PIDSCHIAN N. PIDSCHIANOIDES PRAVDIN). (MATERIALY PO PITANIYU BELOMORSKOGO SIGA (COREGONUS LAVARETUS PIDSCHIAN N. PIDSCHIANOIDES PRAVDIN).) Vopr. Ikhtiol. 2(3): 506-510; Biological Abstracts, Vol. 45, No. 6, Abst. No. 22981. 1964.

The stomachs of 605 whitefish, taken from July to October 1948-50, were examined. The degree of stomach "fullness," or "feeding intensity," was determined on the basis of a 5-point

scale (from 0=empty thru 4=maximum). The stomach contents consisted of molluscs (12 species), crustaceans (6), insects (5), polychaetes and fishes (1 each). The predominant food species varied with geographical and ecological area. Thus, in Gridinskaya Gulf, in July and August, respectively, the young of Gasterosteus aculeatus comprised 61 and 67% of the stomach-content bulk, occurring 30 and 31 times in every 100 morsels. However, in Onega Gulf insects comprised most of the bulk and occurred most frequently. The feeding intensity increased towards the end of summer from 23.4% full in July to 60.4% full in August. Underyearlings (0+) feed chiefly on ostracods, copepods and insects (adults and larvae), while yearlings (1+) also feed on molluscs. Two-year-olds (2+) feed on insects and more on molluscs and different shrimps. Young and adult whitefish occupy different feeding territories as apparent from an analysis of their stomach contents. (L. T. P.)

7248. Shekhanova, I. A. 1961. SOME PROBLEMS CONCERNING PHOSPHORUS METABOLISM IN FISH. (NEKOTORYE VOPROSY FOSFORNOGO OBMENA U RYB.) Tr. Vses. Nauchn.-Issled. Inst. Morsk. Rybn. Khoz. i Okeanog. 44: 60-77; Referat. Zhur., Biol., 1963, No. 13I51; Biological Abstracts, Vol. 45, No. 6, Abst. No. 22991. 1964.

Experiments were conducted with fingerlings and yearlings of scaled and mirror carp. In some experiments "verkhovka" (Leucaspius delineatus) was used. P^{32} in the form of a water solution of Na_2HPO_4 was introduced into the fish by intraperitoneal injection as well as with food and water. A detailed description is given of a special method which permits determination of P excreted by fish into the water, without sacrificing the fish. For this purpose, P was removed from the water (which contained the treated fish) by precipitation with iron chloride in the presence of alkali. The precipitate was then prepared for analysis and P determined. It was established that absorption of P in a solution with a favorable O_2 regime is twice that in a solution with an O_2 deficit. Excretion of P occurred faster in fish which had absorbed the isotope at an O_2 deficit. The amount of P absorbed from the water was found to vary according to the particular metabolism of each fish. Fish with more intensive P metabolism exhibited a faster rate of growth. P is eliminated from the organism by kidneys, gills, and in lesser amounts with excrement. The most rapid rate of P excretion occurred during the first 24 hours and was found to be higher in hungry fish than in satiated ones. In determining the distribution of P^{32}, it was found that radioactivity was high in scales and skeleton and lower in muscles and kidneys. Injected P produced higher activity in kidneys and bones and lower activity in blood than did P absorbed from the water. In fingerlings, 95.5% of P^{32} absorbed from the water entered organic compounds during the first hour after injection. With injected P, transfer to organic compounds occurred more slowly. Bibliography includes 14 titles.

7249. Shentyakova, L. F. (Inst. Reservoir Biol., Acad. Sci., USSR., Borok, USSR). 1962. ON THE ROSA LEE PHENOMENON. (O FENOMENE ROZY LI.) Vopr. Ikhtiol. 2(3): 480-485; Biological Abstracts, Vol. 45, No. 6, Abst. No. 22993. 1964.

The common finding that in older fish populations forms with more narrow annual scale rings, or more narrow growth zones (reflecting a slower growth rate in the first year) are more frequent than in younger populations, is known as Lee's phenomenon. Results based on a study of 1500 bream (Abramis brama) and 1400 roach (Rutilus rutilus) showed that the more rapidly-growing young of each species are more frequently selected against, especially by fish predation and fishing pressure. In roach, such selection was observed to occur not only in the fish's first year, but in succeeding years as well. The above findings indicate that Lee's phenomenon not only applies to migratory and semi-migratory fishes, as previously established, but applies to restricted, or non-migratory, forms as well. (L. T. P.)

7250. Tsuruta, Arao (Shimonoseki Coll. Fish., Shimonoseki City, Japan). 1963. DISTRIBUTION OF PLANKTON AND ITS CHARACTERISTICS IN THE OCEANIC FISHING GROUNDS, WITH SPECIAL REFERENCE TO THEIR RELATION TO FISHERY. Jour. Shimonoseki Univ. Fish. 12(1): 13-214. Illus. Maps; Biological Abstracts, Vol. 45, No. 6, Abst. No. 22998. 1964.

In the North Pacific good fishing grounds for salmon from June to July were usually found not in the inshore waters with a rich population of diatoms but in off-shore waters populated with large-sized zooplankton, chiefly copepods. In the trawling grounds of the northeastern Bering Sea, the distribution of plankton in June suggested classification of the waters into three regions: (1) the northwestern region represented by the neritic plankton of the subarctic waters; (2) the southern region represented by trichoplankton; and (3) the northeastern region represented by siraplankton. On the other hand, the results of the test trawling suggested that a good fishing ground with a high possibility of economic success was found in the waters south of 58° N with transparency relatively high and temperature higher than 2° C on the bottom, namely in the region covered by the trichoplankton. The yellowfin sole, halibut, Alaska cod, Alaska pollack, and pink shrimp were the important members of the catch. In tuna fishing grounds in the equatorial Pacific, the waters in the North Equatorial Current were poor in plankton, whereas those in the Equatorial Counter Current were very rich. It seems to be due to the fact that the Equatorial Counter Current, which flows from the Philippine Islands to the Marshall and Caroline Islands and then far eastward, is more nutritive than the North Equatorial Current which flows westward in the Central Pacific. Hemiaulus haukii and Planktoniella sol can be adopted as the indicator species of the diatom of the North Equatorial

Current and the Equatorial Counter Current, respectively. On the other hand, the adjacent waters of the Phoenix Islands, where the presence of an upwelling has previously been reported, were very rich in plankton flora and fauna and a good catch of tuna was observed there. Concerning the Indian Ocean, the following 5 waters were surveyed: (1) the waters west of the Greater Sunda Islands; (2) central part of the North Indian Ocean; (3) southeastern part of the Arabian Sea; (4) eastern part of the Indian Ocean; and (5) the Bay of Bengal. In the tuna fishing grounds west of the Greater Sunda Islands, plankton was richer, both quantitatively and qualitatively, in the southern parts (waters adjacent to Bali, Lombok, and Sumbawa) than in the northern parts (adjacent waters of Sumatra). This was thought to be due to enrichment by waters of the northwest Australian coast origin flowing northwards. In the central part of the North Indian Ocean, rich plankton was found in the western waters where the water masses of both surface and subsurface layers intermixed. In the eastern part of the Indian Ocean, the presence of a steep gradient of temperature and salinity was observed between 15° S and 18° S; this was thought to form the latitudinal boundary in the distribution of plankton. In the winter in the Bay of Bengal, the oceanic species occurred rather exclusively in the central parts, whereas the neritic ones predominated near the shore. The distribution of both oceanic and neritic water masses could be induced from the frequency of occurrence of these species. Also a dense population of diatoms was found in the on-shore waters from the north of the bay to the east; this is thought to be more or less due to the influence of monsoon drift and of the inflowing of the Ganges and Irawady. The stomach contents of 5 species of salmon in the North Pacific were examined. In the dog salmon, the stomach contents were analyzed in relation to gonad maturity. Thirty species of "Hyperiidae" (pelagic amphipods) and 16 species of Chaetognatha from the Indian Ocean were collected, identified, and described. Samples of 14 species of Copepoda, rare in the adjacent waters of Japan, were collected. (From Auth. Summ.)

7251. Vel'tishcheva, I. F. 1961. PENETRATION OF CARBONATE CARBON (C^{14}) FROM WATER, AND ITS DISTRIBUTION IN THE FISH BODY. (PRONIKNOVENIE UGLERODA (C^{14}) KARBONATA IZ VODY I RASPREDELENIE EGO V TELE RYBY.) Tr. Vses. Nauchn.-Issled. Inst. Morsk. Rybn. Khoz. i Okeanog. 44: 23-36; Referat. Zhur., Biol., 1963, No. 13I59; Biological Abstracts, Vol. 45, No. 6, Abst. No. 23000. 1964.

Penetration and distribution of C^{14} in fishes maintained in water containing dissolved $NaHC^{14}O_3$ was studied in experiments with yearling carp, Leucaspius delineatus, and young sturgeons. As much as 92.7% of C penetrates through the gills into the body of the fish, and 7.3% through the skin, accumulating chiefly in bone tissue (nearly 60-65%). The most intensive utilization of C was observed during the period of organ formation (in sturgeons at V, VI, VII stages of development). The rate of C penetration into the fish's body is governed by the concentration of the radioactive solution. The appearance of C^{14} in organic compounds, organs, and tissues was noted already after a 2-hr exposure of the fish to the isotope. A particularly large amount of C^{14} was observed in glycogen and in the complex proteins of the vitreous humor of the eye, in dermal bones, and also in the encephalon and the medulla. The highest radioactivity was maintained by glycogen over a long time. In hungry fish liver and muscle glycogen radioactivity was significantly higher than in satiated ones. With food deficiency, the fish utilized carbonates dissolved in water for building organic substances. The quantity of C consumed and the degree of its utilization for muscular and energy metabolism were different in different species of fish.

7252. Steen, Johan B. (Inst. Zoophysiol., Univ. Oslo, Blindern, Norway). 1963. THE PHYSIOLOGY OF THE SWIM BLADDER IN THE EEL ANGUILLA VULGARIS. III. THE MECHANISM OF GAS SECRETION. Acta Physiol. Scand. 59(3): 221-241; Biological Abstracts, Vol. 45, No. 6, Abst. No. 23935. 1964.

The mechanism of gas secretion has been investigated by analysis of blood samples from arteries and veins at both poles of the rete associated with the gas gland. During gas deposition, as measured by gas analyses of the bladder content, the blood is enriched in lactic acid as it circulates in the bladder epithelium. The pH of this blood is about 1 pH unit lower than that in the blood entering the rete from the gills. Part of the lactic acid diffuses from venous to arterial capillaries in the rete. A gradient in gas tension across the rete is produced partly by the existing acid gradient, and partly by the delayed response of the gas tension to the change in acid content which the blood undergoes as it passes the rete. The results strongly support the theory that gas concentration occurs by a counter current multiplication in the rete of a primary gradient induced by the addition of acid electrolytes to the venous blood. The measured values on acid content, pH, and blood flow agree very well with the values which have been found adequate, through calculations on the potentialities of such systems, to produce gas pressures higher than those actually measured, and it is concluded that this secretory mechanism will explain secretion of all the atmospheric gases even in deep sea fishes. (Auth.)

7253. Trifonova, A. N. 1958. INCREASE IN SURVIVAL FOLLOWING ADAPTATION TO THE ACTION OF HARMFUL AGENTS. (POVYSHENIE OBSHCHEI ZHIZNESTOIKOSTI PRI ADAPTATSII K DEISTVIYU POVREZHDAYUSHCHIKH AGENTOV.) Zhur. Obshchei Biol. 19(3): 187-201; Referat. Zhur., Biol., 1959, No. 60982; Biological Abstracts, Vol. 45, No. 6, Abst. No. 24881. 1964.

A change in dissimilating metabolism was studied in order to determine whether there was an

increase in survival following adaptation to unfavorable factors, accompanied by metabolic changes. Experiments were carried out on the roe of smelt, and salmon, and planaria. These experiments showed that the increase in viability of the embryos and also of the fish, following adaptation to unfavorable environmental conditions, was achieved by single changes in dissimilating metabolism and, in particular an increase in glycolysis and fall in respiration. The survival of embryos, adapted to one factor, increased their resistance to other factors. The increase in general resistance was accompanied by identical metabolism during the embryonic development period following adaptation, and close to the dominant axial gradient of the embryos. Thus, there was a change in the Pasteur-Meyerhof equilibrium in the direction of a rise in anaerobic processes. In addition, the increased resistance was associated with a rise in protein synthesis, which induced not only more rapid growth, but also better adaptation to the environment. (Courtesy NSF (PL 83-480) 1963)

7254. Latta, William C. (Pigeon River Trout Res. Sta., P. O. Box 7, Vanderbilt, Michigan). 1963. THE LIFE HISTORY OF THE SMALLMOUTH BASS, MICROPTERUS D. DOLOMIEUI, AT WAUGOSHANCE POINT, LAKE MICHIGAN. Michigan Dept. of Cons., Bulletin of the Institute for Fisheries Research No. 5, 56 pp.

A study of the life history of the smallmouth bass was made at Waugoshance Point, Lake Michigan, in 1953-1955. The investigation was concerned with reproduction, growth, movement, abundance, and mortality rates.

Some of the fastest growing male bass reached sexual maturity at 3 years (10.2 inches) and the fastest growing females reached maturity at 4 years (12.8 inches); all males were mature at 5 years (average total length 10.9 inches) and all females were mature at 7 years (average length 14.2 inches).

Nesting activities of the smallmouth bass began when water temperatures reached the sixties (° F.). The typical bass nest was about 1 1/2 feet in diameter; it was built on gravel and rubble in a protected bay at a depth of about 2 feet. The number of eggs collected from two nests in June 1954 averaged 7,437 and the black fry collected from three nests in 1954 averaged 2,054.

Although common shiners spawned in the bass nests, they did not appear to be detrimental to bass nesting. Activities of fishermen were not apparently detrimental to the completion of nesting in 1954. Temperature fluctuations were indirectly responsible for most nest failures. The male bass guarded the fry for 7 to 10 days. Fry dispersal took place 30 to 35 days after eggs were observed in the nest. The bass had an average overall growth increment of about 1.5 inches each year and reached legal size (10 inches) in their fourth year of life.

A total of 3,141 bass were tagged with a No. 3 Monel metal strap tag fastened around the premaxillary and maxillary bones of the left upper jaw.

An analysis of the tag recoveries from nets and anglers showed little movement of the bass either to, or away from, Waugoshance Point. The larger fish moved the greater distances and were captured in nets more often than smaller fish.

Estimates of the abundance of bass 10 inches or longer were made, using the Petersen method. The size of the population of smallmouth bass in the spring of 1954 at Waugoshance Point, estimated on the basis of trap-net recoveries, was 6,007; on the basis of angler returns the estimate was 5,264 bass. In 1955 the same estimates were 4,920 and 4,184 bass, respectively.

The total mortality rate for 1954, using mark and recapture of groups of fish in two successive years, was 58 percent. From a population estimate of fish available to anglers during 1954, and an estimated harvest for the year, a fishing mortality of 22 percent was calculated.

Anglers caught 1,996 bass during the 1954 fishing season. This estimate was based on the catch of bass per hour per angler, counts of the number of fishermen's cars, average number of fishermen per car and the total time involved. (From Auth. Summ.)

7255. Shumilo, R. P. 1959. THE PARASITIC FAUNA OF FISH IN THE LOWER REACHES OF THE RIVER DNIESTER. (K VOPROSU O PARAZITOFAUNE RYB NIZOV'EV REKI DNESTRA.) Izvest. Moldavsk. Filiala Akad. Nauk SSSR 8(53): 31-41; Referat. Zhur., Biol., 1960, No. 56154; (Translation) Biological Abstracts, Vol. 45, No. 6, Abst. No. 26390. 1964.

The parasitic fauna of the fish in the lower reaches of the Dniester was studied in 1951-1952. Among the 111 species found, there were 114 Sporozoa, 1 coelenterate, 31 trematodes, 26 monogenetic trematodes, 16 cestodes, 7 nematodes, 2 acanthocephala, 3 leeches, 1 mollusk, and 10 crustaceans. Fresh-water species predominate; 9 species are marine; 12 species are reported for the first time in the USSR. A heavy infection of fish with larval worms reaching sexual maturity in fish-eating birds was found. A mass infection of the intestinal wall of the goby, Neogobius fluviatilis, with cysts of the microsporidian, Glugea anomala, was found. (Courtesy NSF (PL 83-480) 1963)

7256. Aasen, Olav (Fiskeridirek. Havforskningsinstitutt, Bergen, Norway). 1963. LENGTH AND GROWTH OF THE PORBEAGLE (LAMNA NASUS BONNATERRE) IN THE NORTHWEST ATLANTIC. Fiskeridirekt. Skrifter Ser. Havunders. 13(6): 20-37; Biological Abstracts, Vol. 45, No. 6, Abst. No. 26617. 1964.

A total of 2066 fish were measured, usually for dorsal length (anterior edge of the first dorsal fin at the base of the anterior edge of the precaudal pit). In a comparison of 122 fish, dorsal length correlated closely with total length. Total length ranged from 85 to 252 cm, mean = 188.57 $\pm$ 0.77 cm (6 = $\pm$ 34.2 cm). Males and females did not differ significantly in mean length, thus had the same average growth rate. The porbeagle may reach 20 or even

30 years of age. They probably reproduce yearly. Usually mating is in September or October, with a gestation period of about 8 months. (R. P. E.)

7257. Gerasimov, V. V. 1962. FEEDING BEHAVIOR IN CLUPEA HARENGUS HARENGUS IN THE SCHOOL AND OUTSIDE THE SCHOOL IN AQUARIUM CONDITIONS. (PISHCHEVOE POVEDENIE MURMANSKOI SEL'DI V STAE I VNE STAI V AKVARIAL'NYKH USLOVIYAKH.) Tr. Murmansk. Morsk. Biol. Inst. 4. 8. 254-259; Referat. Zhur., Biol., 1963, No. 4I28; Biological Abstracts, Vol. 45, No. 6, Abst. No. 26629. 1964.

C. h. harengus, caught in the fattening period and placed in aquaria as schools, acclimatized well and began to feed. The feeding rate was proportional to the number in the school. Isolated fish did not feed. When caught in a period of reduced feeding activity, Chipea did not feed for a long time. Their placement in a school of intensively feeding fish also had no effect for a long time on their feeding activity. Pollack and codfish living in aquarium schools did feed. Isolated pollack specimens did not feed for 10-20 days, but single cod specimens began to feed within 2-5 days after capture.

7258. Greeson, Phillip E. (Univ. of Kentucky, Lesington). 1963. AN ANNOTATED CHECKLIST OF FISHES FROM DIX RIVER AND TRIBUTARIES EXCLUSIVE OF HERRINGTON RESERVOIR. Trans. Kentucky Acad. Sci. 24(1/2): 23-27; Biological Abstracts, Vol. 45, No. 6, Abst. No. 26631. 1964.

7259. Jankovic, Draga (Biol. Inst., Belgrade, Yugoslavia). 1961. TAXONOMICAL AND ECOLOGICAL STUDIES ON THE SOFTMUZZLED TROUT (SALMO OBTUSIROSTRIS OXYRHYNCHUS S.) FROM THE RIVER BUNA. (TAKSONOMSKA I EKOLOSKA ISPITIVANJA NA MEKOUSNOJ PASTRMCI IZ REKE BUNE.) Rec. Trav. Inst. Biol. Beograd 5(4/5): 3-31. Illus.; Biological Abstracts, Vol. 45, No. 6, Abst. No. 26634. 1964.

The river Buna where the trout (Trutta obtusirostris oxyrhynchus S.) lives, represents a remarkable water-rich river some 10 km long. This left tributary of Neretva joins the latter below Mostar. According to Taler (1952) this trout represents 99% of all salmonids from Buna. It is characterized by a range of morphological particularities among which the most remarkable are: the elongate muzzle, small, fleshy mouth with teeth covered a great deal by thickened skin, the cranial bone convex in the orbital region, large number of the pyloric caeca (70) and peculiar body pigmentation. Comparing the morphological characters of the trouts from Buna with other dalmatian trouts (Trutta obtusirostris) using the data of Heckel, Steindachner and Karaman many common characters or many obvious differences can be established, showing on the one hand their close relation and on the other hand the consequences of their long spatial and ecological isolation. In order to establish eventual common characters displayed by these trouts and ohridean salmonids, a comparison of the former with the "letnica" (Salmo letnica typicus K.) and "belvica" (Trutta ohridana S.) using the data of Stefanovic (1948), Steindachner (1892) and Karaman (1924, 1927) has been made. Clear differences in a whole range of morphological characters, particularly in the number of backbone vertebrae, of the pyloric caeca, lateral line scales and other features, point to the fact that the trout from Buna and also "letnica" and "belvica" represent separate endemic salmonid spp. It can be assumed that the endemic spp. from the lake Ohrid and from dalmatian waters were closely related in the past, but after a long geographical isolation and adaptation to the specific life conditions in the lake Ohrid, they have acquired specific morphological and ecological characters in which they are actually clearly distinct. In the same way, another comparative morphological and ecological analysis of the trout from Buna and the Asiatic salmonid Brachymystax, based on the data of Berg (1923) and Nikolsky (1956) has shown that the assumption that the latter spp. are closely related is well founded, the relation having lost every importance as a result of the long spatial and, therefore, also an ecological isolation. The reproduction period, the period of sexual maturation, the number of the pyloric caeca and gill outgrowths of the first rakers and ecological and morphological moments which put them undoubtedly close. Nevertheless, the latter as well as former cases need detailed morphological, ecological and genetical studies before any reliable and complete conclusion could be made. The sexual dimorphism in immature trouts from Buna, as well as in those in process of sexual maturation is slightly expressed. Significant difference has been found only in the height of the posterior part of the dorsal fin, the latter being a little higher in males, and in the length of the upper maxillary which is longer in males. The growth rate in length has been studied on the base of the actual body lengths, and the growth in the previous years using the method of Monastirsky. The determination of age has been done by examination of the growth zones in the scales situated below the dorsal fin. The maximum growth rate in length is reached in the first year, decreasing further with age. A stagnation of the decrease rate, and of the growth constant has been recorded between the 4th and 5th year in males, and between the 5th 6th, and 7th year in females, indicating obviously the changes occurring at the age of full maturity. The growth rate in weight has not been studied in yearlings. The maximum rate has been reached between 4th and 5th year in males, and between 3rd and 4th year in females. The length and weight growth of males and females during the 1st and 2nd year is approximately the same. Later on, during the 3rd year the females grow faster not only in length but in weight also. This intensification of growth rate in females has been recorded also in other examined age groups. Because of the lack of the trout young less than one year old, the process of sexual differentiation has not been closely studied. Nevertheless, it has been observed that it could last until the 2nd year. It is assumed that the phase of sexual differentiation must take place early, i. e. in

less than one year, or in one year old trout while the delay in formation of the sex cells in one of the sexes could be ascribed to the harmful influence of the intestinal and abdominal parasites--nematodes, which have been found in large numbers (78) particularly in those specimens with an expressed delay in sexual differentiation. The maturation period has been determined according to the general aspect of testes and ovaries, as well as on the base of microphotos of their histological sections. The full maturity of males occurs mainly between the 4th and 5th year, rarely earlier. The full maturity in females takes place a little later than in males when they are 5-7 years old. The regime of natural nourishment was studied only in May. The vernal nourishment consisted mainly of aquatic organisms: Chironomidae, Amphipoda, Ephemeroptera, Trichoptera and others. Numerically predominate Chironomidae, representing 90.57% of the total food, while other organisms have been recorded in small numbers. Having in mind that the trout from Buna spawn mainly in the course of March, April, and May, fishing should be prohibited from March 1 to June 1. Protective measures should facilitate spawning of these fish under the natural conditions regardless of existing artificial spawning grounds. The trout should be protected, therefore, until the age when they reach the length of 35 cm. This would make possible the spawning of these fish once or twice in the course of their life. (Auth.)

7260. Kharchenko, L. N. 1962. ON INTRASPECIFIC AND INTERSPECIFIC OF GOLDFISH. (O VNUTRIVIDOVYKH I MEZHVIDOVYKH OTNOSHENIYAKH U SEREBRYANOGO KARASYA.) In: Problemy vnutrividovykh otnoshenii organizmov. (Problems of intraspecific relations of organisms.) Tomsk. Univ.: Tomsk. 67-69; Referat. Zhur., Biol., 1962, No. 11I14; (Translation) Biological Abstracts, Vol. 45, No. 6, Abst. No. 26636. 1964.

A histological analysis of gonads in females of a unisexual population of goldfish (Carassius auratus) and of gonads of both sexes of crucian carp (C. carassius) and chub (Leuciscus cephalus) from the lakes of the Chelyabinsk Region showed that their condition in goldfish and chub was much the same, but different from that of the crucian carp. Chub appears to participate in the reproduction of goldfish in these lakes. Crosses between closely allied spp. (crucian carp and goldfish) may lead from gynogenesis, which is the usual method of development in these goldfish, to hybridization, with the result that sp. specificity of population will be lost. The phenomenon of gynogenesis produces a great variety of relationships between crucian carp and other fish spp., which lead to a strengthening of the crucian carp spp.

7261. Kiselev, I. V., and G. G. Korotkevich. 1962. ON INTRASPECIFIC RELATIONSHIPS OF CARP. (O VNUTRIVIDOVYKH OTNOSHENIYAKH U KARPA.) In: Problemy vnutrividovykh otnoshenii organismov. (Problems of intraspecific relations of organisms.) Tomsk. Univ.: Tomsk. 229-231; Referat. Zhur., Biol., 1962, No. 11I15; (Translation) Biological Abstracts, Vol. 45, No. 6, Abst. No. 26637. 1964.

Carp fingerlings derived from a single pair of parents possess a high degree of variability; under poorest feeding conditions, extreme variants were found to differ in weight by a factor of 9-10; under best feeding conditions, they differed in weight by a factor of 2-3. In the case of 2000 specimens of marked carp fingerlings, derived from a single pair of parents and observed up to age V+, groups were found which differed in characteristics of growth as well as in external structure. These biological peculiarities were associated with the character of the foraging migrations of the parents during the period preceding spawning, as well as with the composition of the food rations and the number of males that participated in spawning.

7262. Paloumpis, Andreas A. (Illinois State Univ., Normal, Illinois). 1963. A KEY TO THE ILLINOIS SPECIES OF ICTALURUS (CLASS PISCES) BASED ON PECTORAL SPINES. Trans. Illinois State Acad. Sci. 56(3): 129-133. Illus.; Biological Abstracts, Vol. 45, No. 6, Abst. No. 26648. 1964.

The spp. of Ictalurus occurring in Illinois can be identified by using diagnostic characters found on the pectoral spine. Included is a key to the 5 spp. of Ictalurus and drawings of the 5 spp. discused in the key. (Auth.)

7263. Ergens, Radim (Czech. Acad. Sci., Prague, Czechoslovakia). 1963. TWO NEW PARASITIC WORMS OF ALBANIAN FISH: PSEUDOCHETOSOMA LEUCISCI N. SP. (TREMATOIDEA) AND ANCYROCEPHALUS COBITIS N. SP. (MONOGENOIDEA). (UBER PSEUDOCHETOSOMA LEUCISCI N. SP. (TREMATOIDEA) UND ANCYROCEPHALUS COBITIS N. SP. (MONOGENOIDEA) ZWEI NEUE PARASITISCHE WURMER DER FISCHE ALBANIENS.) Zeit. Parasitenk. 22(4): 287-291. Illus.; Biological Abstracts, Vol. 45, No. 6, Abst. No. 26443. 1964.

Pseudochetosoma leucisci (host: Leuciscus cephalus albus) is found in the gall bladder of the fish. Ancyrocephalus cobitis n. sp. (host: Gobius cobitis) attacks the gills of the host fish. Descriptions are presented for both of the new spp. (J. G.)

7264. Kulakovskaya, O. P. 1961. DATA ON CARYOPHYLLAEIDAE FAUNA (CESTODA, PSEUDOPHYLLIDEA) FROM THE SOVIET UNION. (MATERIALY K FAUNE CARYOPHYLLAEIDAE (CESTODA, PSEUDOPHYLLIDEA) SOVETSKOGO SOYUZA.) (English summ.) Parazitol. Sb. 20. 339-355; Referat. Zhur., Biol., 1962, No. 6K32; Biological Abstracts, Vol. 45, No. 6, Abst. No. 26446. 1964.

Material was collected in 1950-1959 from fish from Ukrainian waters (Uzh, Tissa, Prut, Dnestr, Pripyat', and the Shatskie lakes). Material given to the author from other waters (Neman, Dnepr, N. Donets, Amur, Pechora, Mologa, and others) was treated. This work contains a preliminary description of 18 spp. of Caryophyllaeus. Three spp. of

the genus Archigetes are parasites of oligochaetes, the rest of fish. Up to the present time 6 spp. have been known, primarily for W. Europe (Caryophyllus brachycollis, Paraglaridacris silesiacus, Biacetabulum appendiculatum, Khavia baltica, Monobothrium wagneri) and for Japan (K. japonensis). This is the first time they have been noted in the USSR. In the intestines of dace (Leuciseus leociscus) from the Danielevskii bottom land of the N. Donets a n. sp., Monobothrium auriculatum, was found and is described. From groundlings (Murgurnus) of the Zei river basin and Cobitis taenia which were collected in Carpathian waters, Paracaryophyllaeus dubininae, is described. The author expresses and substantiates his opinion for transferring Caryophyllaeus parvus into the genus Khavia. A key has been worked out for Caryophyllaeus from fish of the USSR.

7265. Roitman, V. A. 1961. PROBOSCIS WORMS (ACANTHOCEPHALA) OF FISH OF THE ZEYA RIVER BASIN. (SKREBNI RYB BASSEINA R. ZEI.) Tr. Gel' mintol. Lab. Akad. Nauk SSSR 11: 194-207; Referat. Zhur., Biol., 1963, No. 2K84; (Translation) Biological Abstracts, Vol. 45, No. 6, Abst. No. 26459. 1964.

In 1958-1959 in the basin of the Zeya River, 2062 specimens of fish belonging to 56 spp. were examined. Six spp. of Acanthocephala were found in 21 spp. of the fish. Two spp., Neoechinorhynchus carassii and N. simansularis, were new; one, Hebesoma violentum, was recorded for the first time in the USSR; and 3 others, Acanthocephalorhynchoides ussuriensis, Paracanthocephalus tenuirostris, and P. curtus, had been previously found in the Amur River. It is noted that the Amur basin and China share a common fish acanthocephalan fauna.

7266. Miller, Helen Carter (Dept. Zool., Oklahoma State Univ., Stillwater). 1963. THE BEHAVIOR OF THE PUMPKINSEED SUNFISH, LEPOMIS GIBBOSUS LINNEAUS), WITH NOTES ON THE BEHAVIOR OF OTHER SPECIES OF LEPOMIS AND THE PIGMY SUNFISH, ELASSOMA EVERGLADEI. Behaviour 22(1/2): 88-151. Illus.; Biological Abstracts, Vol. 45, No. 7, Abst. No. 27117. 1964.

7267. Zusser, S. G. 1961. DIURNAL VERTICAL MIGRATIONS OF PLANKTOPHAGOUS FISHES. (SUTOCHNYE VERTIKAL'NYE MIGRATSII PLANKTONOYADNYKH RYB.) Tr. Vses. Nauchn.-Issled. Inst. Morsk. Rybn. Khoz. i Okeanog. 44: 177-186; Referat. Zhur., Biol., 1963, No. 13I45; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27150. 1964.

In order to explain the causes of diurnal vertical migrations of planktophagous fishes, a study was made of responses of sated and hungry fish to light. "Verkhovka" (Leucaspius delineatus), in which reflexes to light and darkness were developed by the food-incentive method, was used as experimental material. It was established that hungry fishes prefer light, and sated ones darkness. Darkness assumed a signaling significance only when the fish were fed under these conditions. The defensive reflex is expressed more strongly in sated fish. On the basis of these experiments and data from the literature, it is assumed that sated fish descend into sea depths in the morning, seeking protection from external stimuli (bright light, predators, ship noises, etc.).

7268. Antipova, O. P. 1961. THE RYBINSK RESERVOIR. (RYBINSKOE VODOKHRANILISHCHE.) Izvest. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 50: 31-50; Referat. Zhur., Biol., 1963, No. 5D267; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27217. 1964.

Filling of the Rybinsk Reservoir began in 1941 and continued for 7 years. Its area is 455,000 ha; its volume, 25.4 km^3; its mean depth, 5.6 m and the maximum depth, 30 m; and its watershed area, 150,500 km^2. The variation in its level is 3.15 m. In 1948 the most numerous among the phytoplankton were blue-green algae and diatoms, and the biomass was about 2.2 mg/l. From 1946 to 1948 the zooplankton consisted of 138 species and the average biomass in July was 0.216 g/m^3 and in September 0.300; in the period 1953-1955 it was 0.4-0.9 g/m^3. There is little variety in the benthos. In 1948 its average biomass was 4.7 g/m^2, in 1953-1955 2.0. The decreased productivity of the bottom is caused by slight deposits of clay and a low content of easily assimilated organic matter in the soil of the bottom. Of the 38 species of fishes which lived in the lakes and other bodies of water in the flooded zone, 30 are now living in the reservoir. Fishing is based on bream, zander, pike, burbot, and roach. All of the plankton-eating and predatory fish have increased in size, but the bottom feeders (except the ruffe) have deteriorated. Unfavorable influences on the fisheries have been the fall in the water level in unfavorable years and the fluctuation of the level during the day. Commercial fish production is low. The author explains the reasons for this and suggests measures to increase productivity.

7269. Antipova, O. P. 1961. SOME BASIC INFORMATION ABOUT RESERVOIRS OF THE USSR WHICH ARE ALREADY BUILT, ARE BEING BUILT, OR ARE PLANNED. (OSNOVNYE SVEDENIYA O SUSHCHESTVUYUSHCHIKH, STROYASHCHIKHSYA I PROEKTIRUEMYKH VODOKHRANILISHCHAKH SSSR.) Izvest. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 50: 261-269; Referat. Zhur., Biol., 1963, No. 5D258; Biological Abstracts, Vol. 45, No. 7, Abst. No. 27218. 1964.

The information concerns 119 major reservoirs. Data include the river or lake source, year filled, area, volume, maximum and mean depths, maximum length, average long-term water turnover, decrease in water level for an average year, and anticipated catch of fish.

7270. Bogoyavlenskaya, M. P. 1961. TECHNIQUE OF MASS MARKING OF STURGEON YOUNG WITH CA^{45} BY WAY OF THE WATER. (METODIKA MASSOVOGO MECHENIYA MOLODI OSETRA CA^{45} CHEREZ VODU.) Tr. Vses. Nauchn.-Issled. Inst.

Morsk. Rybn. Khoz. i Okeanog. 44: 151-155; Referat. Zhur., Biol., 1963, No. 14I11; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27219. 1964.

For mass marking of young sturgeon with Ca^{45}, it is recommended that 60-100 specimens, at a rate of 200 mg/l, be placed for 2 hours in still water containing dissolved Ca^{45} at a concentration of 300 microcuries per liter. For more permanent marking, the concentration of stable P should be raised to 10 mg per liter of water. Water should be aerated to preclude an O_2 deficit. Before dumping into the river, the spent solution should be freed from Ca^{45} in a cation exchanger.

7271. Chistyakova, I. P. 1961. EFFECT OF CARBON DIOXIDE ON GROWTH OF STURGEON LARVAE AND THEIR OXYGEN UPTAKE. (VLIYANIE UGLEKISLOTY NA ROST LICHINOK OSETRA I POTREBLENIE IMI KISLORODA.) Tr. Vses. Nauchn.-Issled. Inst. Morsk. Rybn. Khoz. i Okeanog. 44. 15-22; Referat. Zhur., Biol., 1962, No. 9I46; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27221. 1964.

With respect to reaction to CO_2 content, larvae of sturgeon from the Kura River are divided into 2 groups: larvae in the V-VI developmental stage and larvae in the VII-VIII developmental stage. In larvae of the first group prolonged exposure to a slightly increased content of CO_2 (15-20 mg/l) led to a decrease in growth rate, in food utilization and in respiration rate. In larvae of the 2nd group, sensitivity to CO_2 content of the water decreased with increasing CO_2 concentration. In larvae reared at 3-6 mg/l CO_2, O_2 uptake rate fell off when the CO_2 concentration was suddenly raised to 60-80 mg/l. The O_2 uptake rate in sturgeon larvae reared at 60-80 mg/l CO_2 increased when they were transferred to water with a low CO_2 content.

7272. Denisov, L. I., and E. V. Meisner. 1961. THE IVAN'KOVO RESERVOIR. (IVAN'KOVSKOE VODOKHRANILISHCHE.) Izvest. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 50: 19-30; Referat. Zhur., Biol., 1963, No. 5D262; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27223. 1964.

The Ivan'kovo Reservoir was founded on the Volga River in 1937; it has an area of 32.7 km^2, a volume of 1.12 km^3, an average depth of 3.4 m, and a maximum depth of 19 m; the area of its watershed is 40.57 km^2. There is a considerable fall (2.5-4.5 m) in the water level in winter. The chemical composition varies considerably from one year to the next. As the water level falls the mineral content increases and at low water the mineral content is higher than that of the Volga. In the first year after regulation of the flow of the Volga the phytoplankton increased, but it dropped off in subsequent years. Among the zooplankton, copepods were dominant in the first year, cladocerans later, and in the 1950's larvae of Dreissensia appeared. The total population of zooplankton increased faster than that of the Volga. In the first year there was an increase in the number and biomass of the benthos over those during the period before regulation of the river. In later years the population of benthos decreased. After the reservoir was created, there was an increase in the density of roach, perch, bream, and zander, and a decrease in rheophilic fishes and, to some extent, pike. In the first few years there was an unfavorable effect, especially on the development of bream, from the great fall in the water level in winter (80%) and from the failure to carry out certain measures for the protection of fisheries. At present, conditions are favorable for the natural development of bream, provided there is no discharge of waste water during spawning. A number of restrictions and measures related to conservation have been applied to the reservoir; they are directed toward the replenishment of the stocks of valuable fishes, primarily bream and zander.

7273. Fujihara, M. P., and P. A. Olson. 1962. INCIDENCE AND VIRULENCE OF COLUMNARIS. U. S. Atomic Energy Comm. Res. and Develop. Rept. HW-72500. 151-155; Biological Abstracts, Vol. 45, No. 7, Abst. No. 27227. 1964.

Fish samples from the Columbia River system showed a low incidence of columnaris disease compared to fish from an artificial spawning channel. Strains collected varied from avirulent to highly virulent. Ploidy of Chondrococcus columnaris was found to have questionable significance to virulence differences, although the high virulent strains tested were diploid and the avirulent were haploid. Prolonged sublethal irradiation had no effect on virulence. (Authors)

7274. Grandilevskaya-Deksbakh, M. L. 1961. GENERAL FEATURES OF THE BOTTOM FAUNA AND THE FOOD OF FISHES IN THE KAMA RESERVOIR FROM 1955 TO 1959. (OSNOVNYE CHERTY DONNOI FAUNY I PITANIYA RYB KAMSKOGO VODOKHRANILISHCHA (1955-1959 GG.).) Tr. Ural'sk. Otd. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 5: 131-175; Referat. Zhur., Biol., 1963, No. 5D266; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27228. 1964.

Limnophilic species and those extremely resistant to freezing predominated (chiefly tendipedid larvae). In the first year after the reservoir had filled the benthal biomass was 5-6 g/m^2, but then a decrease was noted. The distribution and amount of the benthos was critically influenced by industrial sewage and drainage from bogs. Uncontaminated inlets had the most benthos. In the drainage area there was a decrease in the mollusk population and macrophyte area. There was also a decrease in the range of distribution of the rheophilic species Pontogammarus sarsi. The food supply of the reservoir might support a fairly high fish production rate if there were a decrease in the industrial sewage draining into it. Introduction of Rivulogammarus lacustris from Ural lakes is recommended to increase the food supply.

7275. International North Pacific Fisheries Comm. (International North Pacific Fish. Comm., Vancouver, B. C., Canada). 1961. THE EXPLOITATION, SCIENTIFIC INVESTIGATION, AND MANAGEMENT OF HERRING (CLUPEA PALLASI) ON THE PACIFIC COAST OF NORTH AMERICA IN RELATION TO THE ABSTENTION PROVISIONS OF THE NORTH PACIFIC FISHERIES CONVENTION. Internatl. N. Pacific Fish. Comm. Bull. 4. 1-100. Illus. Map; Biological Abstracts, Vol. 45, No. 7, Abst. No. 27229. 1964.

7276. Kamyshnaya, M. S. 1961. ON THE BIOLOGY OF HYBRIDS OF AUTUMN CHUM SALMON AND PINK SALMON (ONCORHYNCHUS KETA (WALBAUM)) INFRASP. AUTUMNALIS BERG X O. GORBUSCHA (WALBAUM) FAMILY SALMONIDAE. (O BIOLOGII GIBRIDA KETA I GORBUSHI (ONCORHYNCHUS KETA (WALBAUM) INFRASP. AUTUMNALIS BERG X O. GORBUSCHA (WALBAUM) SEM. SALMONIDAE).) Nauchn. Dokl. Vysshei Shkoly. Biol. Nauk 4. 29-33; Referat. Zhur., Biol., 1962, No. 1I47; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27232. 1964.

Sakhalin fish hatcheries incubate roe of chum salmon fertilized with milt from pink salmon. First hybrid specimens were noted September 4, 1959, at the Takoi River dam. Both female and male hybrids were larger than their parents. Female hybrids were larger than males, and in weight and fecundity they resembled chums. Males attained maturity at age I, females at age II. Maximum fecundity was estimated at 6800 eggs. In mature ovaries the eggs were found to be dissimilar in size.

7277. Karzinkin, G. S. 1961. SOME RESULTS AND PROSPECTS OF PHYSIOLOGICAL RESEARCH IN THE FIELD OF FISH CULTURE. (NEKOTORYE ITOGI I PERSPEKTIVY FIZIOLOGICHESKIKH ISSLEDOVANII V OBLASTI RYBNOGO KHOZYAISTVA.) Tr. Vses. Nauchn.-Issled. Inst. Morsk. Rybn. Khoz. i Okeanog. 44: 3-14; Referat. Zhur., Biol., 1963, No. 14I49; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27233. 1964.

Two periods in the development of the physiology of fishes are noted. The principal trend of research of the first period (the 1890's and the early decades of the 20th century) was determined by the work of the Zunze school which concerned itself with the intensification of fish culture in ponds through control of nutrition and improvement of bodies of water. Investigations of the 2nd period (beginning with the 1930's) are characterized by studies of metabolism in relation to environmental factors (Skladovsky school), as well as by physiological studies of the nutrition of fishes inhabiting lakes, seas, and ponds. The Skladovsky school dealt also with problems of the physiology of blood and of gaseous exchange in fishes in relation to climate, with the physiology of propagation, etc. A short account is given of reports (included in the symposium "Transactions of the All-Union Scientific Institute of Maritime Fisheries and Oceanography" 1961, 44) on various problems of fish physiology. The use of isotopes facilitated the study of many aspects of mineral metabolism and made possible the determination of the significance of hydrochemical factors in the lives of fishes. Research on analyzers, on fish endocrinology and on a number of other problems has been weak.

7278. Kirpichnikov, V. S. 1961. GROWTH AND SURVIVAL RATE OF CARP LABELED WITH RADIOACTIVE CALCIUM AND THE EFFECT OF LABELING ON HEREDITY. (ROST I VYZHIVAEMOST' KARPOV, POMECHENNYKH RADIOAKTIVNYM KAL'TSIEM, I VLIYANIE MECHENIYA NA NASLEDSTVENNOST'.) Izvest. Gos. Nauchn-Issled. Inst. Ozernogo i Rechnogo Khoz. 51: 255-265, 272; (English summ.) Referat. Zhur., Biol., 1962, No. 9I18; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27236. 1964.

Growth and viability of carp fry were unaffected when these animals were held for 1-2 hours in a solution of $Ca^{45}Cl_2$, the activity of which did not exceed 2 microcuries per liter. This is because the greater part of Ca^{45} was washed away when the animals were transferred to pure water, and the isotope, after absorption through skin and gills, accumulated mainly in bone tissue. Since the path length of β-particles in living tissue is short, internal radiation from bone elements failed to exert a significant effect on the vital organs. No decrease in viability was observed in offspring of males labeled with radioactive Ca. It is concluded that a solution of $Ca^{45}Cl_2$ with a specific activity of up to 1.5 microcuries per liter can be used for labeling carp fry in fish culture studies.

7279. Kozhevnikov, G. P. 1961. THE GOR'KII RESERVOIR. (GOR'KOVSKOE VODOKHRANILISHCHE.) Izvest. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 50: 51-61; Referat. Zhur., Biol., 1963, No. 5D272; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27238. 1964.

The reservoir has been in existence since 1955. Its volume is 10.3 km^3, maximum depth 23 m, average depth 6.4 m, rate of replacement quarter 5 times a year. There is a sharp division into 2 parts: the river-like upper part, where the current velocity of 0.1-0.2 m/sec. is retained, and the lacustrine part which is near the dam in which there is practically no current. The maximum drop in the water level is 1.5-2.0 m. The hydrochemical conditions are favorable. A belt of macrophytes is slowly developing. This reservoir is of the mesotrophic type. The biomass of zooplankton is 7.1 kg/ha in the river-like part and 24.9 kg/ha in the part near the dam. The average biomass of the benthos for the entire reservoir is 58.6 kg/ha. The limnophilic fishes--bream (Abramis brama), white bream (Blicca bjoerkna), Abramis sapa, roach, and chekhon (Pelecus culturatus)--are the most important for fisheries. The rheophilic species stay in the upper part. The growth rate compared with fishes in the river has improved. The reservoir will be the bream type with a fish productivity of 15-30 kg/ha.

7280. Krogius, F. V., and A. G. Ostroumov. 1961. USE OF AERIAL INSPECTION TO APPRAISE THE DENSITY OF UTILIZATION OF SPAWNING GROUNDS BY PACIFIC SALMON. (PRIMENENIE AEROMETODOV DLYA OTSENKI ZAPOLNENIYA NERESTILISHCH TIKHOOKEANSKIMI LOSOSYAMI.) In: Primenenie aerometodov v landshaftnom issledovanii. (Use of aero-methods in topography research.) Akad. Nauk SSSR: Moscow-Leningrad. 132-145; Referat. Zhur., Biol., 1963, No. 4I62; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27239. 1964.

Aerial visual observations and photographs were used to estimate salmon migration to the spawning grounds of Kamchatka. Flying operations were in the fall, from the end of July to September 10, in PO-2 and AN-2 airplanes at a height of 100-300 m and in an MI-1 helicopter at a height of 50-150 m. The aerial photography was done by AFA-33/50 at a focal distance of 500 mm and with a frame size of 30 x 30 cm. Typical sections which had been photographed were selected and plotted on a large-scale map, as well as the landmarks defining each section of the water. From the photographs, a determination of salmon numbers was made, their distribution noted, and the data applied to the entire body of water. On the photographs it was impossible to distinguish salmon of different species. Therefore, the percentage relationship between different species had to be established on the basis of visual observations. Only visual estimate of the density of stocking of spawning grounds was possible in small rivers and slow-flowing spring-fed creeks. Bibliography with 30 references.

7281. Lucas, C. E. (Dept. Agric. and Fish. Scotland, Mar. Lab., Aberdeen, Scotland). 1963. INTERNATIONAL COLLABORATION IN FISHERIES RESEARCH. A HISTORICAL REVIEW, WITH PARTICULAR REFERENCE TO THE NORTH ATLANTIC REGION. FAO Fish. Biol. Tech. Paper 33. 1-16. Illus.; Biological Abstracts, Vol. 45, No. 7, Abst. No. 27242. 1964.

7282. Lukin, A. V. 1963. THE KUIBYSHEV RESERVOIR. (KUIBYSHEVSKOE VODOKHRANILISHCHE.) Izvest. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 50: 62-76; Referat. Zhur., Biol., 1963, No. 5D263; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27243. 1964.

The Kuibyshev Reservoir on the Volga, the largest reservoir at present in existence has an area of 5901 km^2, of 56.1 km^3, mean depth of 9.4 m and maximum depth of 41.0 m. Filling began in November 1955 and was finally completed in the spring of 1957. The Kuibyshev Reservoir is of the eutrophic hydrocarbonate-carbonate type with a high trophic level. Among the zooplankton the crustaceans are predominant and their value as food increased 100-fold over their value in the Volga before the reservoir was filled. The biomass of the benthos of the floodplain reservoirs before the formation of the reservoir was 7.1 g/m^2, the average biomass in the fall of 1956 was 12.1, and in the fall of 1957 it was 17.5: thus there was a 15-fold increase in the food resources of the bottom-dwelling organisms. There is a massive development of Dreissena in the central part of the reservoir and in the area near the dam. Before regulation of the flow, the Volga and the accessory reservoirs had more than 40 species of fish of which the bream was dominant economic species. The formation of mature stocks of valuable adult fish was aided by a ban on fishing for 2 years before flooding. Favorable conditions for spawning and foraging resulted in good stocks. For sturgeon the spawning conditions were good only in the upper part of the reservoir, but their young took at once to the flooded lands. In 1957 the fish had a high growth rate. In 1958 the rate was lower because of unfavorable weather and increased competition for food. Then bream, blue bream, and sterlet became the dominant fish; the role of pike is decreasing and the main predator is the zander. Industrial wastes are exerting an unfavorable effect on the condition of the stocks.

7283. Malikova, E. M., and N. I. Kotova. 1961. THE IMPORTANCE OF ANTIBIOTICS IN THE ARTIFICIAL REARING OF YOUNG SALMO SALAR. (ZNACHENIE ANTIBIOTIKOV PRI ISKUSSTVENNOM VYRASHCHIVANII MOLODI LOSOSYA.) Tr. Nauchn. Inst. Rybn. Khoz. Latviisk. SSR 3: 431-443; Referat. Zhur., Biol., 1963, No. 7I63; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27247. 1964.

Salmon parr were raised in ponds for 1 year, to the downstream migration stage, on a mixture of KPT-III. Biomycin (I), furazolidone (II), penicillin (III), and terramycin were added to the food. The addition to 1 kg of food of 50 mg of I, II, and III gave best results. Somewhat less effective results were obtained with mixture of I and III only, or of II and III. A significantly lower weight and high food coefficient was noted in fingerlings getting only one of these antibiotics. The chemical composition of the tissue of fish getting different antibiotics was the same as a whole. The application of III alone (50 mg in 1 kg of food) led to marked impoverishment of tyrosine and tryptophan in the protein. The bodies of the parr fed with the KPT mixture had a higher vitamin content (B_1 and B_2) in comparison with fish which fed on natural food. The highest content of B_1 and B_2 was found in fish getting I, II, and III.

7284. Pomerantsev, G. P. 1961. THE KAMA RESERVOIR. (KAMSKOE VODOKHRANILISHCHE.) Izvest. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 50: 88-101; Referat. Zhur., Biol., 1963, No. 4D249; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27254. 1964.

The Kama Reservoir, 1720/km^2 in area, was built in 1954. Studies were made in winter at a period when the level was high, and all of the shallow waters were covered with deposits of ice. In the winter, as a result of lowering of the level, the effect of industrial discharge and the discharge of

humic waters from wooded and swampy bottom lands is particularly marked. The phytoplankton is poorly developed, and diatoms predominate. In the zooplankton, 95 forms were counted with filtering crustaceans and sedimenting rotifers predominating; only in the upper portion and in the zones influenced by industrial waters do carnivores predominate. The zooplankton is least abundant in the upper reaches and in sections where industrial waters flow in; it is richest in Sylvichskii Bay (2.1 g/m^2), Obvinskii Bay (3.2 g/m^2), and In'vinskii Bay (1.1-1.6 g/m^2). The most abundant development of benthos was observed in the first year, with oligochaetes (Limnodius hoffmeisteri) predominate. Reservoir is of the pike-bream type. However, water level, erosion, pollution, accumulation of rubbish, and scarcity of fishing places contribute to an assessed fish productivity in the Kama Reservoir of not more than 10-15,000 metric centners.

7285. Prirozhnikov, P. L. 1961. THE ZOOPLANKTON OF RESERVOIRS AND ITS SIGNIFICANCE FOR THE NUTRITION OF FISH. (ZOOPLANKTON VODOKHRANILISHCH I EGO ZNACHENIE DLYA PITANIYA RYB.) Izvest Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 50: 323-340. 452; (English summ.) Referat. Zhur., Biol., 1963, No. 4D252; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27256. 1964.

In large and medium-sized reservoirs, the principal groups of zooplankton develop in different ways depending on the region; in the upper and middle sections, rotifers predominate, in the lower section, near the dam, cladocerans prevail. The largest biomass of zooplankton in most reservoirs occurs in the middle and lower sections and amounts to ca. 0.7-6.1 g/m^3, which is many times greater than that of the uncontrolled sections of the river located higher upstream. A sharp increase in the biomass and zooplankton occurs after the flow of the river is regulated. Rapid development of bacteria and algae provide a high rate of growth and reproduction of the cladocerans, copepods, and rotifers which are nutritionally important for the young of all species of fish inhabiting the reservoirs. In order to improve the composition of the food supply in reservoirs, the author recommends stocking with Limnocalanus macrurus, Heterocope caspia, H. appendiculata, Epischura baicalensis, E. chankensis, and Senecella calanoides.

7286. Rudakov, N. P. 1961. CHARACTERISTICS OF CA^{45}, SR^{90}, CE^{144}, AND CS^{137} IN THE BODY OF A FISH AND METHODS OF MARKING YOUNG FISH WITH RADIOACTIVE ISOTOPES. (OSOBENNOSTI POVEDENIYA V ORGANIZME RYB CA^{45}, SR^{90}, CE^{144}, CS^{137} I METODY RADIOMARKIROVKI MOLODI RYB.) Izvest. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 51: 165-254, 271-272; (English summ.) Referat. Zhur., Biol., 1963, No. 14I56; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27258. 1964.

A study was made of absorption and excretion patterns of a number of mineral ions in fish. For marking and for determining the degree of absorption of mineral substances from the surrounding medium, fish (pond carp, crucian carp, salmon, rainbow trout, and the omul cisco were held for a definite period in solutions of $Ca^{45}Cl_2$, $Sr^{90}Cl_2$, $Ce^{144}Cl_3$, $Cs^{137}Cl$, the solutions having various activities. Accumulation of Ca^{45} depends on the relative proportions of active and stable isotopes in the water, on the total concentration of Ca, pH and chemistry of the water, and age of the fish, but it is not temperature-dependent. In fishes the curve for absorption of total Ca in relation to solution concentration is similar to Langmuir's adsorption isotherm. Maximum accumulation of Ca is attained at a concentration of nearly 80-100 mg/l; in the trout it is attained at about 120-130 mg/l. Ca^{45} is first absorbed by external body parts of the fish and then, more slowly, by muscles, bones, and internal organs. A large quantity of Ca is washed out of the fish in the course of the first hour of washing. The rate of Ca^{45} loss is a maximum on washing with water having a pH of 6.2 and a mineral content of 1000 mg/l. Ca^{45} excretion rate is in every case greater than its natural disintegration rate, which indicates a continuous Ca exchange in bone tissues of fish. Significant accumulation was observed in fingerlings of trout and carp. Analysis of bone ash and of Ca, precipitated from the ash by ammonium oxolate, provides the most reliable method for identifying labeled fish. This method enables identification of labeled fish 2 1/2 years after labeling. Winter fasting reduces the radioactivity by 70-90% and decreases the amount of total Ca by 22%. For marking young fish it is expedient to use $Ca^{45}Cl_2$ solutions with an activity of nearly 1.5 millicuries per liter for trout, and 1 millicure per liter for carp. In solutions having equal activities, the rates of uptake and excretion of Sr^{90} are significantly higher than those of Ca^{45}; the largest part of Sr^{90} is absorbed by fins and skin. For marking fish with Sr^{90}, solutions of $Sr^{90}Cl_2$ with an activity of 20-30 microcuries per liter are adequate. Ce^{144} and Cs^{137} are accumulated very rapidly. Cs^{137} accumulates in muscles, gills, and internal organs of fish. Ce^{144} accumulates primarily in liver and gills and secondarily in bony structures. C^{144} excretion rate is extremely low, while that of Cs^{137} is high. Bibliography includes 280 titles.

7287. Towsley, Sidney J. (Dept. Zool., and Hawaii Mar. Lab., Univ. Hawaii, Honolulu). 1963. THE EFFECT OF ENVIRONMENTAL IONS ON THE CONCENTRATION OF RADIOCALCIUM AND RADIOSTRONTIUM BY EURYHALINE TELEOSTS. In: Radioecology. Proceedings of the First National Symposium on Radioecology. Reinhold Publishing Corporation: New York 22. pp. 193-199; Biological Abstracts, Vol. 45, No. 7, Abst. No. 27265. 1964.

Euryhaline fish (Tilapia mossambica) exposed for two weeks to fresh water, fresh water plus added Ca and sea water containing equal concentrations of Sr-89 show concentrations of the nuclide in their tissues in inverse order to the Ca plus Sr,

but not directly related to the absolute amounts of the ions. Although 50 times more stable Ca is present in salt water, the amount of Sr-89 retained in the tissues was not 50 times greater in salt water fish. It is assumed that the Sr++ in the environments cannot account for the differences. Exposure of T. mossambica to fresh waters and sea waters with varying concentrations of Ca++ and Sr++, and ratios of these ions to one another, shows that radiocalcium and radiostrontium accumulation and retention are controlled by the total divalent ions present as well as other salts in the environment. The effects of increased concentrations of Sr++ in the environment has little effect upon the total radioactive Ca plus Sr absorbed, nor upon their ratio. It would appear, therefore, that for decontamination of aquatic environments addition of Ca salts and other divalent ions could be more effective against absorption of radiocalcium and radiostrontium than addition of Sr++ alone. It does not appear that release of radiocalcium or radiostrontium into marine or brackish environments would result in as much absorption and retention of radioactive Sr or Ca as in fresh water environments. This is particularly important to the species which show migratory or osmotic regulation habits. Thus, under differing environmental conditions, the same species of fish may show varying degrees of accumulation and retention of radiocalcium and radiostrontium. (Auth.)

7288. Tyurin, P. V. 1961. A CLASSIFICATION OF RESERVOIRS FOR FISHERY PURPOSES AND A METHOD FOR DETERMINING THEIR FISH PRODUCTIVITY. (RYBOKHOZYAISTVENNAYA KLASSIFIKATSIYA VODOKHRANILISHCH I METODIKA OPREDELENIYA IKH RYBOPRODUKTIVNOSTI.) Izvest. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 50: 429-444, 454; (English summ.) Referat. Zhur., Biol., 1963, No. 5D259; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27266. 1964.

The classification is based on the biohydrochemical classification of reservoirs of I. V. Baranov and on patterns of the broadly topographic gradient of development of the benthos set up by I. I. Ioffe. Five classes of reservoirs are distinguished, depending on their productivity: (1) exceptionally high, more than 60 kg/ha; (2) high 30-60 kg/ha; (3) medium, 15-30 kg/ha; (4) low, 7-15 kg/ha; and (5) extremely low, 2-7 kg/ha. The author singles out the following types: salmon-whitefish, of which a typical class 5 example is the Sandal reservoir; whitefish-bream type (4, Vygozero); bream-zander type (3, Rybin; 2, Ivan'kovo; 1, Kuibyshev); bream-carp-zander type (1, Dneprov; 2, Tsimlyan; 3, Karlov); carp-zander type (2, Veselov; 3, Proletarsk); carp type (3, Bukhtarma); carp-trout type (4, Katta-Kurgan; Bratsk); salmon-whitefish-bream type (5, Mingechaur).

7289. Watson, D. G. 1962. CHINOOK SALMON SPAWNING IN THE COLUMBIA RIVER. U. S. Atomic Energy Comm. Res. and Develop. Rept. HW-72500. 148-150; Biological Abstracts, Vol. 45, No. 7, Abst. No. 27273. 1964.

The number of chinook salmon spawning in the Columbia River near Hanford was the second highest since surveys were started in 1947. Priest Rapids Dam appears to affect the distribution and number of spawning fish in this area. (Auth.)

7290. Yakovleva, A. N. 1961. THE SARATOV RESERVOIR. (SARATOVSKOE VODOKHRANILISHCHE.) Izvest. Gos. Nauchn-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 50: 77-87; Referat. Zhur., Biol., 1963, No. 5D268; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27275. 1964.

The author predicts the hydrological, hydrochemical, and hydrobiological conditions and the success of fishery in the reservoir. Its area is 218,000 ha; it is 350 km long; its maximum depth is 30 m, its average depth 7 m, and its "coefficient of replacement of water" is 17 times a year. The O_2 content on the surface will be higher than in the river, but will decrease in the layers near the bottom to 3-5 mg/l. The amount of biogenic substances and BOD will be greater than in the Volga. In the reservoir as a whole the biomass of zooplankton will be 5-6 g/m^3; in the benthos it will be 10-12 g/m^2. The fishery productivity will be 28 kg/ha when it becomes stabilized. The most important fishes will be the bream, the blue bream, and the pike. After establishment of a sturgeon hatchery and a nursery (which will also release the young of wild carp and other species), the fish productivity will rise to 45 kg/ha. To increase the food supply it will be necessary to import aquatic organisms in the food chains of the fishes.

7291. Yandovskaya, N. I. 1961. METHOD OF RAISING ATLANTIC SALMON (SALMO SALAR) FINGERLINGS. (K METODIKE VYRASHCHIVANIYA SEGOLETOK LOSOSYA.) Izvest. Gos. Nauchn. Inst. Ozernogo i Rechnogo Rybn. Khoz. 51: 28-36, 267; (English summ.) Referat. Zhur., Biol., 1963, No. 7157; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27276. 1964.

In raising salmon, supplemental feeding is recommended during the stage before the yolk-sac is absorbed. The composition of the diet during this period is not of decisive importance for future growth and development of the fish. Supplemental feeding should begin when the larvae have 40-50% of the yolk not yet absorbed, and should end after full disppearance of the yolk and larval organs. Poor provision of food during this period is one of the main reasons for increased deaths of young salmon. After disappearance of the yolk, survival and weight of the larvae depended on a rich diet. Prolonged feeding with oligochaetes led to a reduction in both indices. Application of mixed food containing blood-meal gave still poorer results. The fingerlings did best when fed with spleen alone or with a vitaminized mixture.

7292. Yandovskaya, N. I., and Kh. A. Leizerovich. 1961. REARING SALMON YEARLINGS. (O KOMBINIROVANNOM VRASHCHIVANII

DVUKHLETOK SEMGI.) Nauchn.-Tekh. Byul. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 13/14. 69-71; Referat. Zhur., Biol., 1963, No. 5I85; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27277. 1964.

Experimental rearing of salmon yearlings was carried out at the Kandalaksha fish hatchery in 1960-61. The starting material consisted of 1-year-old fish raised in ponds and reservoirs. Rearing was in a pond 0.9 ha in area, as well as in troughs 1.5 m^2 in area each. In August the yield of yearlings from ponds was 45%, with an average weight of 5.7 g, and the yield from the reservoir was 65% with an average weight of 11.5 g. Survival rate of trough-cultivated yearlings ranged from 50 to 75% at an average weight of 2.5-5.8 g. In 1961 pond-reared yearlings averaged 10.3 g in weight. The young reared in reservoirs were fed a mixture composed of fish meal, cod roe and canned capelin (Mallotus villosus), supplemented with beef liver and 20% yeast cake.

7293. Yudanov, K. I. 1961. DETECTION OF DISBURSED FISH NEAR THE SEA-BOTTOM BY MEANS OF ECHO SOUNDERS. (O REGISTRATSII EKHOLOTOM RAZREZHENNOI RYBY U DNA.) Tr. Nauchn.-Issled. Inst. Rybn. Khoz. Latviisk. SSR 3. 175-183; Referat. Zhur., Biol., 1963, No. 14I106; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 27279. 1964.

The echo sounder frequently fails to detect fish at a low concentration near the sea bottom, and in cases where detection does occur, the readings do not agree with the catches. Demersal fishes are concealed by unevenness and roughness of the bottom located within the entire range of the ultrasonic beam. Even with a flat bottom, the echo sounder registers only a part of the fish present. Substantial numbers of fish are caught by marginal rays of the beam; the distance between such fishes and the ship turns out to be greater than the depth of their submersions, and they are recorded below the bottom line. The diameter of the zone in which fish are detected above the bottom line (over a perfectly even bottom) is given by the formula $D = \sqrt{8 \Delta h}$, where Δ is the width of the water column in which the fish are found, and h is the depth of the site. The smallest area from which the echo sounder registers demersal fish during the ship's motion is

$$S = l_1 D + \frac{\pi D^2}{4}$$

where l_1 is the distance traveled by the ship between 3 signals of the echo sounder. The value of l_1 depends upon the speed of the ship and the frequency of transmission. The echo sounder cannot detect fish in an area (S) which has uneven places with widths exceeding Δ. An echo sounder capable of detecting fish at low concentration near the sea-bottom should have a very narrow ultrasonic beam, considerable sensitivity, and the ability to make large-scale records.

7294. Branson, Branley A. (Kansas State College, Pittsburg). 1963. THE OLFACTORY APPARATUS OF HYBOPSIS GELIDA (GIRARD) AND HYBOPSIS AESTIVALIS (GIRARD) (PISCES: CYPRINIDAE). Jour. Morphol. 113(2): 215-229. Illus.; Biological Abstracts, Vol. 45, No. 7, Abst. No. 28051. 1964.

The external, internal and histological anatomy of the olfactory organ is described and illustrated. The olfactory capsule is about 1.0 mm in diameter and contains a rosette consisting of 18 to 26 and 14 to 22 lamellae in H. gelida and H. aestivalis respectively. Compound lamellae are described, apparently for the first time. Accessory nasal sacs are developed in both species. The entire nasal epithelium is clothed by short cilia which cause currents of water to be pulled through the chambers. Three types of hair-bearing olfactory cells are described and illustrated. The primary olfactory nerves, associated with a well-developed nervous terminalis, joins olfactory bulbs which are borne by closely approximated, broad crura. The olfactory tracts end on anterior and lateral tuberculae. The development of the olfactory system is correlated with the extremely well-developed system of taste buds and related to the turbid habitat of the fishes. (Auth.)

7295. Kobayashi, Hiroshi. 1962. A COMPARATIVE STUDY ON ELECTRORETINOGRAM IN FISH, WITH SPECIAL REFERENCE TO ECOLOGICAL ASPECTS. III. SPECTRAL SENSITIVITY OF FISH RETINA AND ITS ECOLOGICAL ASPECTS. Jour. Shimonoseki Coll. Fish. 11(3): 455-472. Illus.; Biological Abstracts, Vol. 45, No. 7, Abst. No. 28117. 1964.

The spectral sensitivity of the retina was investigated in 20 species of fishes, using the size of electroretinogram (ERG) as index and it was ecologically considered from their behavior, particularly at the depth in which the fishes live. It was found that the maximum sensitivity tended to shift toward shorter wave-lengths with the depth of habitat of fishes. In shallow water fishes the spectral sensitivity curve had the maximum in the range of longer wave-length, and had submaximum in the curve. Particularly, in Halichoeres, Dictyosoma and Acanthogobius, red sensitive element or photopic element was found to be dominant. The shift of the maximum was usually found noticeably by light-adaptation. In fishes inhabiting a sea deeper than some 100 meters, the sensitivity curve had the maximum in shorter wave-length and had generally no submaximum. Moreover, in these fishes the sensitivity curve had a narrow spread against the spectrum and showed slightly or not the shift of the maximum by light-adaptation. From these results it may be assumed that the fishes inhabiting deeper seas have achromatic vision, and shallow water fishes have chromatic vision. The tendency was obviously shown that the threshold intensity of the retina obtained in shallow water fishes was higher than that of the fishes inhabiting deeper places. (Auth.)

7296. Kobayashi, Hiroshi. 1962. A COMPARATIVE STUDY ON ELECTRORETINOGRAM IN FISH, WITH SPECIAL REFERENCE TO ECOLOGICAL ASPECTS. IV. ELECTRORETINOGRAM IN

TELEOST FISH, WITH REFERENCE TO ECOLOGICAL ASPECTS. Jour. Shimonoseki Coll. Fish. 11 (3): 473-538. Illus.; Biological Abstracts, Vol. 45, No. 7, Abst. No. 28118. 1964.

Various inductions were made in order to record the electroretinogram (ERG) of teleost fish including 24 species of marine and fresh-water fishes, and the wave-form of the ERG and the visual functions investigated by use of the ERG were considered on the basis of the ecological situation of the fish species. The wave-form of the ERG's were classified into three groups according to the character of off-potential in the dark-adapted eye: Group I, the ERG showed positive potential dominantly and was hard to elicit the off-response. This form was found in nocturnal fishes, such as Anguilla, Misgurnus, and others. The ERG of this group seemed to resemble the excitatory form of vertebrate ERG. Group II, the ERG showed positive potential dominantly in the case of stimulation with weak light, but the remarkable negative potential in that with intense light. Off-response was also unremarkable. This form was found in Saurida, Scorpaenodes, and Cyprinus. These fishes are usually known to inhabit deeper sea or turbid water. Group III, the ERG showed negative potential dominantly, and also showed the remarkable off-potential. This type was found in Chrysophrys, Stephanolepis, Lagocephalus, Hoplognathus, Kareius, and others. These fishes are usually known as inhabitants in shallow water and diurnal fishes. This classification seemed to be supported by the visual functions investigated by the ERG. In some species, the effects of potassium chloride, alcohol, urethan, and strychnine on the ERG were investigated, results of which were the same as in past investigations. By the aid of microelectrode the ERG's were recorded from the inverted retina in several kinds of fish. Typical S-potential was obtained in Chrysophrys and Stephanolepis, but some unusual forms of S-potential were found, too. Moreover, it was seen that the impulse superimposed on the S-potential was easily recorded in Fugu and Lagocephalus. Relations between the magnitude of the ERG response and the stimulus intensity were investigated. In benthonic and deeper sea inhabiting fishes, with the increase in stumulus intensity the amplitude height of the ERG attained a plateau state at rather low stimulus intensity. In particular, in the fishes belonging to Group II, such as Saurida and Scorpaenodes, the intensity which caused the suppression of the positive potential was found to be considerably low. Therefore, such intensity as is mentioned above will be considered as an ecological indicator representing the depth of the habitat. A distinction was found in the gradient of the straight line obtained in the linear relation between the logarithm of stimulus intensity and the amplitude height of the ERG, in various species. The gradient of the line (called temporarily L_{10}) usually showed a larger rate in diurnal fishes or shallow water inhabitants and tended to show a smaller rate in accordance with the increase in the depth of the habitat. By using the threshold intensity of stimulus light for eliciting ERG or a size of ERG as index of the retinal sensitivity, the process of light- or dark-adaptation was investigated. Two types of the process of light-adaptation were found: In one type the threshold intensity increased in progress of the adaptation and finally attained to a plateau state. This type was found in nocturnal fishes, such as Anguilla, Misgurnus, and Chelidonichthys. In another type the threshold intensity increased rapidly transitorily at the initial phase of the adaptation, and thereafter the threshold decreased a little slowly, and finally attained a plateau state. This type was found in diurnal fishes, such as Kareius, Chrysophrys, and Stephanolepis. Such differences seemed to be related to the ability which adapted the eye to light. Differential threshold of stimulus light for eliciting ERG was investigated in the light-adaptation with various intensity of adaptation light, in several species, from the results of which a rather great ability of intensity discrimination was found in benthonic fishes, while an inferior ability was found in the fishes of burrowing habit, such as Anguilla and Misgurnus. During dark-adaptation the recovery of the amplitude of ERG required a long time, in general, while that of the threshold intensity was completed more rapidly. The flicker fusion frequency was investigated in several species by using ERG or S-potential. There was a tendency to show a high flicker fusion frequency (ca. 33 c/s) in diurnal and actively swimming fishes, but a low one (ca. 15 c/s) in benthonic and nocturnal fishes. The flicker fusion frequency increased evidently by light-adaptation, in spite of the decrease in amplitude of the potential. In such benthonic fishes as Fugu and Gymnothorax, the highest value of flicker fusion frequency was obtained in a relatively low illumination, for example, of about 30 to 60 lux. Some aspects on the retinal structure were given. The shallow water fishes and the diurnal fishes tend to have a thick retina, though in those fishes the threshold intensity is usually high. The fishes inhabiting deeper sea and the nocturnal fishes tend to show the reverse phenomenon. It was found that the external nuclear layer of the retina was much thicker than the internal in nocturnal and deeper sea fishes, and the internal nuclear layer was much thicker than the external in diurnal and shallow water fishes. The ratio of the thickness of the external nuclear layer to that of the internal nuclear layer corresponded to the value of the L_{10} to some extent. In diurnal fishes or shallow water fishes, they have a tendency to show the ganglion cells large in size or a large number of cells in tertially neuron layer of their retinae. According to the size of the outer segment of visual receptor, the species were classified into some types. This classification was discussed from the ecological situation of the fishes. These distinctions of the retinal structure between the shallow water fishes or diurnal fishes and the deeper inhabitant or nocturnal fishes, are considered to be the morphological basis accounting physiological for the distinctions of the responses to spectral light in the fishes of both types. (Auth.)

7297. Protasov, V. R. 1961. SOME SPECIFIC CHARACTERISTICS OF THE VISION AND THEIR ADAPTIVE SIGNIFICANCE IN THE LIVES OF NINE SPECIES OF FISHES IN THE BLACK SEA. (NEKOTORYE OSOBENNOSTI ZRENIYA I IKH PRISPOSOBITEL'NOE ZNACHENIE V ZHIZNI DEVYATI VIDOV RYB CHERNOGO MORYA.) Tr. Inst. Morphol. Zhivotnykh Akad. Nauk SSSR 39. 72-95; Referat. Zhur., Biol., 1962, No. 8I58; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 28133. 1964.

A study was made of the functional properties of the retina in 9 spp. of fishes from the Black Sea: distinguishing brightness and color in Engraulis encrasicholus L., Trachurus trachurus L., Mullus barbatulus ponticus Essipov, Mugil auratus Risso, Gaidropsarus mediterraneus L., and Raja clavata L.; the perception of movement in E. encrasicholus, the young of M. auratus, fingerlings of Atherina mochon pontica L., specimens of Grenilabrus tinca L., and Sargus annularis L.; and distance of effective vision in E. encrasicholus, M. auratus, A. mochon pontica, and M. barbatulus pontica. The spectrum of colors seen by the fishes' eyes corresponds in spectral composition to the light in the habitats of each of the species. The retinas of the eyes of the pelagic fishes (E. encrasicholus, T. trachurus, the young of M. auratus) and of the littoral fishes (G. mediterraneus and M. barbatulus ponticus) perceived color in the portion of the spectrum from about 400 to 700 mμ, but in the benthic species (R. clavata) it was from about 410 to 650 mμ. The retinas of all the species of fishes studied except R. clavata have two color receptors for the basic colors red and blue. R. clavata has only one color receptor, and this fish cannot distinguish colors. The maximum sensitivity of the daylight color receptors in E. encrasicholus, T. trachurus, and the young of M. auratus is at about 550-560 mμ, while in G. mediterraneus and M. barbatulus ponticus it is at 570-590 mμ. The maximum twilight perception of color in the fishes studied lies in the portion between 500 and 510 mμ. Certain levels of illumination serve as visual color signals of movement, feeding, and interrelations within the schools of fish. The optical time threshold ("moment") of E. encrasicholus, the young of M. auratus, Cyprinus laskir, and the young of A. mochon pontica were shown to be within the limits of 1/50-1/67 second. E. encrasicholus, the young of A. mochon pontica and of M. auratus and C. laskir sense motion within broad limits of illumination: from 10^4 to 10^{-5} and 10^{-7} lux; higher than 10 lux the illumination has feeding and defensive significance; below 10 lux, only the latter. The distance at which pelagic fishes (E. encrasicholus, T. trachurus, M. auratus, and A. mochon pontica), whose absolute threshold of sensitivity to light is 10^{-8} lux, see underwater sources of light at night is identical and depends on the transparency and illumination of the water. The distance at which a fish can see a nonluminous object depends on the transparency and illumination of the water, the contrast between the object and the background, the size of the object, specific visual and developmental features of the structure of the eye and the visual acuity related to this. With daylight illumination and very clear water, a moving fish 5.5 cm long causes a defensive reaction at a distance of more than 3 m in E. encrasicholus, T. trachurus, A. mochon ponticus, M. auratus, and M. barbatulus ponticus. Under these conditions such a fish can be clearly distinguished by E. encrasicholus at a distance of 2.8 m, by A. mochon ponticus at 2.5 m, and by M. barbatulus ponticus at 2.7 m, and by M. auratus at 1 m.

7298. Tamura, Tamotsu (Nagoya Univ., Fac. Agric., Anzyo, Japan), and Warren J. Wisby. 1963. THE VISUAL SENSE OF PELAGIC FISHES, ESPECIALLY THE VISUAL AXIS AND ACCOMMODATION. (Spanish summ.) Bull. Mar. Sci. Gulf and Caribbean 13(3): 433-448. Illus.; Biological Abstracts, Vol. 45, No. 7, Abst. No. 28153. 1964.

The following visual parameters were determined for ten species of pelagic fishes: the extent and direction of lens movement in accommodation, topographic differences in cone density on the retina, the visual axis, the range of accommodation, and the resolving power of the retina. (Authors)

7299. Kholodov, Yu. A. 1958. THE FORMATION IN FISH OF CONDITIONAL REFLEXES TO MAGNETIC FIELDS. (OBRAZOVANIE USLOVNYKH REFLEKSOV NA MAGNITNOE POLE U RYB.) Tr. Soveschanii. Ikhtiol. Komis. Akad. Nauk SSSR. 8. 82-89; Referat. Zhur., Biol., 1960, No. 12795; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 28232. 1964.

Conditional defense and food-obtaining reflexes to magnetic fields were developed in fish (MF-conditional stimulus). Conditional reflexes were formed after 2-5 applications of the combined stimuli and became stable after 12-102 applications. Denervation of the lateral organ and enucleation did not impair conditional reflexes to magnetic fields. An association was noted between MF and light stimuli, manifested by a generalization of conditional reflexes when these stimuli were changed. In blinded fish the development of conditional reflexes to light is feasible. The formation of conditional inhibition to magnetic fields is indicative of the specificity of action of the latter as a conditional stimulus; it does not indicate that magnetic fields act directly on the organism through induction of electrical current during the change of magnetic field. (Courtesy NSF (PL 83-480) 1963)

7300. Vedyaev, F. P., and V. V. Fanardzyan. 1958. STUDIES ON REFLEXES OF CARPS AND LAMPREYS. (OSOBENNOSTI REFLEKTORNOI DEYATEL'NOSTI MINOG I KARPOVYKH RYB.) Tr. Soveshch. Ikhtiol. Komis. Akad. Nauk SSSR 8. 69-76; Referat. Zhur., Biol., 1960, No. 12794; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 28252. 1964.

Experiments on elaboration of conditional

reflexes (CR) in 36 lampreys (by means of the motor-defense method) showed that only the elaboration of a summation reflex was feasible. Inhibition of reflex activity which occurs when the various stimuli are used is frequently due to the development of an inhibitory state. In carps tested under similar conditions, reflexes are easily developed in response to single as well as combined stimuli. Trace conditional reflexes in carps are extremely unstable when series of stimuli are applied. Differential inhibition develops slowly and no delayed inhibition occurs. Analytical and synthetic processes of the central nervous system are weakly developed. (Courtesy NSF (PL 83-480) 1963)

7301. Conroy, D. A. (Univ. Buenos Aires, Fac. Farm. y Bioquim., Buenos Aires, Argentina). 1962. A CASE OF RED SPOTS IN AQUARIUM FISH. (UN CASO DE "MANCHAS ROJAS" EN PECES DE ACUARIO.) (English summ.) Microbiol. Espan. 15(2): 95-99; Biological Abstracts, Vol. 45, No. 7, Abst. No. 29829. 1964.

A disease of Barbus partipentazona is characterized by the appearance of red spots on the lateral body surfaces. Cultures taken from diseased parts produced a heavy growth of a fluorescent pseudomonad which resembled Pseudomonas putida. The bacterium was insensitive to penicillin and terramycin, but sensitive to kanamycin. The condition responded well to treatment with kanamycin at a concentration of 20 γ/g body weight, administered in the form of an aqueous solution by the intraperitoneal route. (Auth.)

7302. Palva, I. P. (II Med. Dept., Univ. Helsinki, Helsinki, Finland). 1963. THE EFFECTIVENESS OF CERTAIN DRUGS IN THE EXPULSION OF THE FISH TAPEWORM. Ann. Med. Internae Fenn. 52 (2): 89-92; Biological Abstracts, Vol. 45, No. 7, Abst. No. 29873. 1964.

The fish tapeworm, Dibothriocephalus latus, was expelled in 35% with Laparin, in 95% with Extractum-filicis, in 52% with Antiphen and in no case with seeds of pumpkin. The result obtained with Extractum-filicis differs significantly ($P < 0.001$) from the other drugs. Extractum-filicis is the most reliable drug. (Auth.)

7303. Frank, Werner (Landw. Hochsch., Stuttgart, W. Germany). 1962. HISTOLOGICAL INVESTIGATION OF CARASSIUS CARASSIUS AURATUS L. (PISCES, TELEOSTEI) AFTER SEVERE ATTACK BY TRICHODINA DOMERGUEI WALLENGREEN, 1897 (PROTOZOA, EUCILIATA). (HISTOLOGISCHE UNTERSUCHUNGEN BEI CARASSIUS CARASSIUS AURATUS L. (PISCES, TELEOSTEI) NACH STARKEM BEFALL DURCH TRICHODINA DOMERGUEI WALLENGREEN, 1897 (PROTOZOA, EUCILIATA).) Zeit. Parasitenk. 21(5): 446-456. Illus.; Biological Abstracts, Vol. 45, No. 7, Abst. No. 30812. 1964.

A history is reported of an attack by the peritrich ciliate Trichodina (Cyclochaeta) domergui upon goldfish (Carassius carassius auratus), in which the fish died. Histological study showed that the parasites are capable of penetrating tissues and holes, grooves, and cavities develop in the gills, as a result of which the host dies. The systematic position of these ciliates is discussed in the light of recent studies. So far it has not been definitively determined which species destroy tissue and which should be considered harmless. Such a determination would, however, be of great importance to the choice of a suitable control method. (Auth. Summ.)

7304. Musselius, V. A. 1962. DIPHYLLOBOTHRIASIS DISEASE OF POND FISH. (ZABOLEVANIE PRUDOVYKH RYB BOTRIOTSEFALOZOM.) Tr. Soveshch. Ikhtiol. Komis. Akad. Nauk SSSR 14. 220-224; Referat. Zhur., Biol., 1963, No. 5K43; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 30814. 1964.

At the Savvinskoe Experimental Farm of the All-Union Research Institute of Pond Fishery, studies were made on the morphology, biology, and pathogenicity of Diphyllobothrium gowkongensis in pond fish (carp and orfe). This parasite was brought into the European section along with young of Ctenopharyngodon idella destined for acclimatization. General information on the morphology of the helminth is given. When 3-year-old specimens of Ctenopharyngodon idella were restocked together with parasite-free carp larvae, a high degree of Diphyllobothrium infection (98.1%) was observed among the latter after 35 days. Toward autumn, infection of yearling carp declined, due to their shift to benthos nutrition. The parasite becomes sexually mature in the definitive host within 30-35 days at a water temperature of 20-22° C. From the eggs falling into the water there emerge within 2 days coracidia which remain on the bottom. The eggs, sensitive to external influences despite their thick membrane, require a temperature of over 18° C for their normal development. Diphyllobothriasis causes a marked weight loss in carp, but does not affect the differential leukocyte count, the number of erythrocytes and leukocytes, or the hemoglobin. Diseased carp were treated with kamala (Glandulae rottlerae) powder in an amount of 100 mg per 20- to 25-g yearlings. Administration of this antihelminthic with the feed on 2 occasions with an interval of 1 day between treatments expels the parasites. Two measures are recommended for the control of diphyllobothriasis: (1) Extermination of the eggs with a solution of chlorine and quicklime and draining and freezing of the bed of the ponds; and (2) dehelminthization of the fish with kamala.

7305. Spasskii, A. A., and V. A. Roitman. 1959. THE NEMATODE FAUNA OF GRAYLING. (O FAUNE NEMATOD KHARIUSA.) In: Voprosy ikhtiologii. (Problems of ichthyology.) Moscow. 12. 177-186; Referat. Zhur., Biol., 1960, No. 71647; (Translation) Biological Abstracts, Vol. 45, No. 7, Abst. No. 30886. 1964.

Graylings of Eurasia are known to harbor 14

spp. of parasitic nematodes. A dissection of 44 specimens of Thymallus thymallus from the river Pechora revealed Cucullanus truttae, Sterliadochona ssavini and Agomospirura sp. It was established that Ichthyobronema ochracea is a synonym of I. tenuissima and that the latter should be transferred to the genus Sterliadochona and is apparently a synonym of S. ssavini. The 3 doubtful findings - Contracoecum aduncum, Bulbodacnitis globosa and Cucullanus sphaerocephalus are excluded from the list of grayling nematodes. (Courtesy NSF (PL 83-480) 1963)

7306. Philpott, C. W. (Biol. Lab., Harvard Univ., Cambridge, Mass.), and D. E. Copeland. 1963. FINE STRUCTURE OF CHLORIDE CELLS FROM THREE SPECIES OF FUNDULUS. Jour. Cell Biol. 18(2): 389-404. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 31513. 1964.

A morphological basis for osmoregulation in the teleosts was studied by comparing the fine structure of chloride cells found in epithelia of the gills of three species of fish: Fundulus heteroclitus which can survive in a wide range of salinities, and F. similis and F. chrysotus which are usually restricted to salt-water and fresh-water environments, respectively. Gills were removed from F. heteroclitus which had been laboratory adapted to either sea-water or pond-water. For a comparison, gills were also removed from the marine F. similis and the fresh-water F. chrysotus which had been adapted to their natural environments. Gill filaments were fixed in Millonig's phosphate buffered (pH 7.4), 1% osmium tetroxide and were embedded in Epon. Thin sections of filaments were stained with lead hydroxide. The cytoplasm of chloride cells of all three species of Fundulus is heavily populated with mitochondria and is filled with tubules of the agranular endoplasmic reticulum (ER). An orderly secretory cycle was indicated for chloride cells of salt-water-adapted F. heteroclitus and the marine F. similis. An amorphous material is observed in the agranular ER. Its density increases towards the apical end of the cell. In the apical cytoplasm, tubules of the agranular ER appear to converge and to discharge the amorphous material into an apical cavity. Except for the actual opening of the apical cavity, the distal end of salt-water-adapted chloride cells is characteristically shielded from the hypertonic environment by thin cytoplasmic flanges projecting from the neighboring epithelial cells. Chloride cells of the fresh-water F. chrysotus resemble chloride cells of pond-water-adapted F. heteroclitus, in that these cells do not have apical cavities with the functional appearance of those in the sea-water-adapted forms. The distal end of fresh-water-adapted chloride cells is typically exposed to the free surface of the gill filament. The possible function of the cell type is discussed. (Authors)

7307. Terner, Charles, and Gregory Korsh (Dept. Biol., Boston Univ., Boston, Mass.). 1963. THE OXIDATIVE METABOLISM OF PYRUVATE, ACETATE AND GLUCOSE IN ISOLATED FISH SPERMATOZOA. Jour. Cell. and Comp. Physiol. 62 (3): 243-249; Biological Abstracts, Vol. 45, No. 8, Abst. No. 31532. 1964.

Rates of oxidation by isolated spermatozoa of the rainbow trout and sunfish of acetate, pyruvate, and glucose were studied by measuring the rates of conversion to $C^{14}O_2$ of the C^{14}-labeled substrates. The spermatozoa oxidized pyruvate and acetate readily, but to have a limited capacity of oxidizing glycose. The patterns of metabolism of the spermatozoa of man, the bull and fish show characteristic differences which may be useful in further comparative studies. The effects of ovarian fluid and of saline solutions on the motility of spermatozoa were examined. (Authors)

7308. Manwell, Clyde, C. M. Ann Baker, and William Childers (Dept. Physiol. and Biophys., Univ. Illinois, Urbana). 1963. THE GENETICS OF HEMOGLOBIN IN HYBRIDS. 1. A MOLECULAR BASIS FOR HYBRID VIGOR. Comp. Biochem. and Physiol. 10(2): 103-120. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 31629. 1964.

Hemoglobins from various bird and fish hybrids have been studied by starch gel electrophoresis and by oxygen equilibrium analysis. In most crosses there are no new proteins--i. e. the electrophoretic patterns for hybrids and for mixtures of the parental hemoglobins are identical. In two of the centrarchid fish crosses the F_1's have new "hybrid hemoglobin" that occurs neither in the parents nor in hemoglobin mixtures. Oxygen equilibrium studies indicate that the "hybrid hemoglobin" has much stronger heme-heme interactions, thus resulting in a molecule with superior blood gas transport properties. Data have also been obtained on several F_2 hybrid populations and on a multiple cross. Besides the obvious significance of such studies for the biochemical basis of "hybrid vigor," this new information on the proteins of hybrid animals is of potential phylogenetic interest, for the hemoglobin electrophoretic patterns of two species of the genus Micropterus can be closely approximated by chain recombination involving hemoglobins of two other species of this genus. (Authors)

7309. Fedorova, G. V. (A. A. Zhdanov State Univ., Leningrad, USSR). 1963. EXPERIMENTAL INVESTIGATION OF THE RESORPTION OF C^{14} BY THE DEVELOPING EGGS AND LARVAE OF FRESH-WATER FISH. (EKSPERIMENTAL'NOE ISSLEDOVANIE POSTUPLENIYA C^{14} V RAZVIVAYUSHCHIESYA IKRU I LICHINKI PRESNOVODNYKHRYB.) Radiobiologiya 3(5): 677-681. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 31719. 1964.

The rate and degree of contamination of eggs and larvae of Carassius carassius L., Rutilus rutilus L., Acerina cernua L., and Alburnus alburnus L. in water containing 2×10^{-6}, 2×10^{-5}, and 2×10^{-4} c/l. C^{14} in the form of $CH_3C^{14}OOH$ were investigated. In water with an activity of 2×10^{-5}, 2×10^{-4} c/l., the eggs of R. rutilus, A. cernua, and A. alburnus accumulated an activity 2-3 times

higher than that of the water within 4 days. During the same time the eggs of C. carassius, which has a longer embryonal period than the other species studied, accumulated an activity not to exceed 1.5 x 10^{-5} -1.37 x 10^{-4} c/kg. On the 7th day, immediately before hatching, the eggs of C. carassius had an activity of 4.71 x 10^{-5} -2.13 x 10^{-4} c/kg. Newly hatched larvae were radioactive, but showed considerably less contamination than the eggs. Within 10 days after hatching, the larvae of R. rutilus, A. cernua, and A. alburnus accumulated an activity 7.6-16.1 times higher than that of the water in a medium containing 2 x 10^{-4} c/l. C^{14}. Beginning with the 11th day, when the yolk sacs of the larvae were used up, the larvae were fed chlorella and scendesmus algae. As a result of C^{14} concentration by the algae, the radioactivity of the larvae increased still further from the 10th to the 20th day. Because of the slower development, the C. carassius larvae accumulated less radioactivity than other species. Uncontaminated larvae of A. alburnus 2 weeks old, on being placed in water containing 2 x 10^{-4} c. of C^{14} per l. and fed with unicellular algae, accumulated C^{14} at a high rate, acquiring a radioactivity 21 times that of the water within 8 days. (L. M. B.)

7310. Kleerekoper, H., and J. Mogensen (McMaster Univ., Hamilton, Ontario, Canada). 1963. ROLE OF OLFACTION IN THE ORIENTATION OF PETROMYZON MARINUS. I. RESPONSE TO A SINGLE AMINE IN PREY'S BODY ODOR. Physiol. Zool. 36 (4): 347-360. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 31887. 1964.

The olfactory perception of the "body odor" or scent of trout stimulates unconditioned individuals of the parasite Petromyzon marinus to increase their locomotory activity which has a circadian rhythm in many members of the species. Under experimental conditions employing tanks divided in 16 compartments and automatic recording of activity and direction, locomotion was directed towards the source of the stimulus. These responses were also present in recently transformed Petromyzon previous to contact with any species of fish. Substitution of the "complete" body odor of trout by nine amino acids and 11 amines, isolatedly and in combinations, obtained from the body odor mixture by means of chemical separation, demonstrated that the responses described are elicited by either one of two amines code-named "C" and "F". The latter amine is by far the more powerful stimulant of the two. (Authors)

7311. Harrington, R. W., Jr. (Entomol. Res. Ctr., Florida State Board Hlth., Vero Beach). 1963. TWENTY-FOUR-HOUR RHYTHMS OF INTERNAL SELF-FERTILIZATION AND OF OVIPOSITION BY HERMAPHRODITES OF RIVULUS MARMORATUS, A CYPRINODONTID FISH. Physiol. Zool. 36(4): 325-341. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 31906. 1964.

Six hermaphrodites kept separately at 25° C August through November received only normal daylight. During daily monitoring, 0800-1700 hr, the time and stage of oviposition was recorded for each egg recovered, and its fertilization time was obtained by subtracting the predetermined incubation period of that stage. Recently and remotely fertilized eggs are laid in randomly jumbled sequence; 78% had been fertilized within the same 24-hr night-day cycle they were laid; 16%, 5%, and 1%, respectively, within the 1st, 2nd, and 3rd preceding cycles. Oviposition is confined to daylight hours; during the overall period, its frequency rose from a low level at 0800-0900 hr to a peak at 1200-1300 hr, returning to the level before 1600-1700 hr. Fertilization (for which evidently may be read ovulation) was minimal between noon and midnight, reached peak frequency at sunrise, and encroached on the daylight hours with swiftly diminishing frequencies. Between August and November, peak oviposition intensity (highest hourly frequencies as distinct from earliest oviposition of the day) shifted from 1200-1300 hr to 0900-1000 hr, counter to the postponement of sunrise. Peak fertilization intensely remained at and was postponed with sunrise, but a secondary peak near midnight became overt in November. The dawn peak reflected fertilizations within fish laying their second season, the secondary peak, those within fish laying their first season, there being progressively earlier fertilization in small fish and vice versa in large ones. Eggs ovulated and fertilized within 24-hr night-day cycles preceding that in which they were laid were emitted increasingly (39%-52%) by small fish and decreasingly (10%-1%) by large ones August to November. The month-by-month advancement of peak fertilization intensity from dawn to midnight in small fish is interpreted as a result of decreasing gonadal lumen capacity with increasing egg retention. (Auth.)

7312. Lowman, F. G. (Puerto Rico Nuclear Ctr., Mayaguez, Puerto Rico). 1963. RADIONUCLIDES IN PLANKTON AND TUNA FROM THE CENTRAL PACIFIC. In: Radioecology. Proceedings of the First National Symposium on Radioecology. Reinhold Publishing Corp.: New York 22. p. 145-149; Biological Abstracts, Vol. 45, No. 8, Abst. No. 31987. 1964.

Three factors appeared to control the selective uptake of radionuclides from sea water by the plankton, omnivorous fish, and carnivorous fish studied. These were isotope dilution by the corresponding stable element or chemically similar element in the sea water, the tendency of divalent cations to complex strongly with biological substrates, and the biological requirements for certain elements in metabolic processes. During the first 48 hours following fallout the plankton in the contaminated area accumulated radionuclides in approximately the same ratio as they occurred in sea water. After one week the radioisotopes of the three elements C, Fe, and Zn were actively taken up by the plankton in comparison to the other radionuclides which were associated with the plankton at percentages similar to those in sea water. Omnivorous fish which feed on the plankton, almost completely excluded the fission products and, on a comparative basis, concentrated Zn-65 and Fe-55, 59, but discriminated against Co-57, 58, 60. Carnivorous tunas, which

feed primarily on omnivorous fishes, discriminated in favor of Zn and Mn and against Fe and Co in comparison to the relative percentages of these radionuclides in their food supply. (Auth.)

7313. Wilkinson, Robert E. (U. S. Dept. Agric., Middle Rio Grande Substa., Los Lunas, N. Mex.). 1963. EFFECTS OF LIGHT INTENSITY AND TEMPERATURE ON THE GROWTH OF WATERSTARGRASS, COONTAIL, AND DUCKWEED. Weeds 11 (4): 287-290; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32027. 1964.

Long-term compensation points in waterstargrass (Heteranthera dubia (Jacq.) MacM.), coontail (Ceratophyllum demersum L.), and duckweed (Lemna minor L.) were near 2-3% full sunlight during a 28-day period. Fresh weight of H. dubia increased as temperature increased from 15 to 30° C and as light intensity increased from 110 to 1000 foot-candles. Fresh weight of C. demersum increased as temperature increased above 20° C and as light intensity increased from 120 550 foot-candles. The L. minor strain used in this experiment was not temperature-dependent and increased in fresh weight and frond number at 25 and 30° C as light intensity increased from 77 to 550 foot-candles. (Auth.)

7314. Favorite, Felix, and Mitchell G. Hanavan (Bur. Comm. Fish., Seattle, Washington). 1963. OCEANOGRAPHIC CONDITIONS AND SALMON DISTRIBUTION SOUTH OF THE ALASKA PENINSULA AND ALEUTIAN ISLAND, 1956. Internatl. N. Pacific Fish Comm. Bull. 11. 57-72. Illus. Maps; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32049. 1964.

Salmon fishing and related oceanographic cruises in the North Pacific prior to 1956 are summarized, and comparison is made between salmon catches and oceanographic features determined from data collected aboard the chartered fishing vessels Mitkof, Celtic, and Paragon in the area south of the Alaska Peninsula and Aleutian Islands in the summer of 1956. No immediate relationship between surface conditions and the presence or abundance of salmon in the eastern Pacific is indicated, but a subsurface temperature front at approximately lat. 48° N coincided with the southern limit of summer catches. In the spring of 1956, however, salmon were caught by the vessels of the Japan Fisheries Agency and a Bureau of Commercial Fisheries vessel as far south as lat. 41° N-42° N. Since limited oceanographic information was obtained in 1956, data collected by various agencies in 1958 are utilized to show the extent and continuity of two oceanographic fronts in the area considered. A salinity front at lat. 42° N coincides with the southern limit of spring catches, and a temperature front at approximately lat. 46° N in the western Pacific, extending to lat. 48° N in the eastern Pacific, coincides with the southern limit of summer catches. Although very little is known concerning the high-seas migrations of salmon, it appears that northward of approximately lat. 48° N in the eastern Pacific and lat. 46° N in the western Pacific, the shallow surface layer north of the temperature frontal zone may cause salmon to remain near the surface, where they would be more susceptible to capture in surface nets during the summer, and does not necessarily imply that they are not present at depths to the southward during this period. (Authors)

7315. Herbert, D. W. M., and D. S. Shurben (Water Pollution Res. Lab., Stevenage, England). 1963. A PRELIMINARY STUDY OF THE EFFECT OF PHYSICAL ACTIVITY ON THE RESISTANCE OF RAINBOW TROUT (SALMO GAIRDNERII RICHARDSON) TO 2 POISONS. Ann. Appl. Biol. 52(2): 321-326. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32051. 1964.

The toxicity of zinc sulphate and ammonium chloride to rainbow trout forced to swim continuously against water currents of 3 known velocities was compared with their toxicity to similar fish tested simultaneously in still water. For fish swimming at 85% of the maximum sustainable velocity, the concentration of ammonium chloride killing 50% at 24 h was 0.81 times that for still water, and the corresponding factor for 48-h exposure to zinc sulphate was 0.70. Current speeds up to 55% of the maximum sustainable velocity produced no detectable increase in susceptibility to either poison. The increase in metabolic rate with current velocity was measured, and its relation to the increase in susceptibility to poisons is discussed. (Authors)

7316. Malikova, E. M., S. O. Apine, and R. E. Shaldaeva. 1961. USE OF VITAMINS AS PROPHYLACTIC AND THERAPEUTIC MEASURES IN DISEASES OF IMMATURE SALMO SALAR IN FISH HATCHERIES. (ISPOL'ZOVANIE VITAMINOV V KACHESTVE PROFILAKTICHESKIKH I LECHEBNYKH SREDSTV PRI ZABOLEVANIYAKH MOLODI LOSOSYA NA RYBOVODNYKH SAVODAKH.) Tr. Nauchn. Inst. Rybn. Khoz. Latviisk. SSR 3: 445-452; Referat. Zhur., Biol., 1963, No. 7I72; (Translation) Biological Abstracts, Vol. 45, No. 8, Abst. No. 32062. 1964.

Salmon fingerlings suffering from ichthyophthiriasis were given double doses of vitamins with the food for 23 days, with a week's break. Significant changes were noted in the blood during the illness (lower Hb and erythrocyte counts, reduced percentage of lymphocytes and an increased ratio of polymorphonuclear leucocytes and monocytes). The amount of B vitamins in the organism was less. The biochemical composition of the fish was little changed. Within 5 days after the beginning of treatment, the deaths were lowered considerably. As a result of the treatment, the leucocyte formula was quickly reestablished, the percentage of Hb rose more slowly, but the number of erythrocytes in the blood only slowly returned to normal. The most effective treatment was a double dose of vitamin A (30,000 I. U. for 1 kg of food). Almost the same effect was obtained in treating trichodiniasis using double doses of vitamins in conjunction with salt baths. Immature pair raised on food enriched with

vitamins up to the time of the illness, unlike fish maintained for a long time on poor-value food, tolerated the illness more easily and recovered more quickly with treatment.

7317. Margolis, Leo (Fish. Res. Bd. of Canada, Nanaimo, B. C., Canada). 1963. PARASITES AS INDICATORS OF THE GEOGRAPHICAL ORIGIN OF SOCKEYE SALMON, ONCORHYNCHUS NERKA (WALBAUM), OCCURRING IN THE NORTH PACIFIC OCEAN AND ADJACENT SEAS. Internatl. N. Pacific Fish. Comm. Bull. 11. 101-156. Maps; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32064. 1964.

A survey of the parasites (mainly metazoan) of sockeye salmon, both in the fresh-water and marine environments, yielded more than 50 species, of which two of fresh-water origin, larval Triaenophorus crassus (Cestoda) in the muscle and Dacnitis truttae (Nematoda) in the intestine, proved to be useful indicators of the geographic origin of sockeye captured at sea. These two parasites have a limited distribution in sockeye stocks in their fresh-water areas of origin and apparently live as long as their host. T. crassus is found only in stocks originating in western Alaska (essentially Bristol Bay) and D. truttae is known only from some sockeye from Kamchatka. Because T. crassus apparently is more common in Bristol Bay sockeye than is D. truttae in Kamchatkan sockeye, the former parasite is more useful in establishing the ocean distribution of Bristol Bay sockeye than is the latter in determining the ocean distribution of Kamchatkan sockeye. No distinctive parasite tag was found in any of the North American stocks originating in rivers tributary to the Gulf of Alaska and the northeast Pacific. Two trematodes acquired at sea, Hemiurus levinseni and Tubulovesicula lindbergi, may be useful in delimiting the general oceanic areas occupied by Asian and North American sockeye but a lack of knowledge regarding their life span in sockeye precludes arriving at any definite conclusions at this time. During the years 1955 to 1959, 12,888 sockeye were examined. These consisted of 1,853 seaward migrants from 24 North American localities, 2,507 adults from 37 North American river systems or coastal areas, 144 adults from two USSR (Kamchatka) rivers, 92 juveniles from British Columbia coastal waters and 8,292 specimens (approximately 62% maturing and 38% immature) from the high seas. The high-seas specimens were collected almost entirely from May through August from many stations across the North Pacific and the Bering Sea and from the Okhtsk Sea off the southwest coast of Kamchatka. Most of the maturing sockeye were taken in May and June and most of the immatures in July and August. The general lack of samples from USSR rivers was partially offset by samples of maturing sockeye from the Sea of Okhotsk and from close to the east coast of Kamchatka. Maturing Bristol Bay sockeye (i. e., infected with T. crassus) were found between latitudes 50°10' N and 59° N westward to 171° E in the Bering Sea and to 168°15' E in the North Pacific Ocean and eastward to 145° W in the northern part of the Gulf of Alaska. Immature Bristol Bay sockeye were found between latitudes 49° N and 60° N from 145° W to 175° E in the North Pacific and between 175° W and 170° E in the Bering Sea. Maturing sockeye of Kamchatkan origin (i. e., infected with D. truttae) were found in the Sea of Okhotsk and from the east coast of Kamchatka eastward to 173°19' E in the North Pacific and to 175° E in the Bering Sea at latitudes varying from 47°30' N to 58° N. Immature Kamchatkan sockeye were found from the east coast of Kamchatka eastward to 169° 56' W in the North Pacific and to 175° W in the Bering Sea, between 48° N and 58° N. Because the majority of sockeye originating in Bristol Bay and Kamchatka do not carry a parasite identifying their area of origin and because of certain limitations in the sampling, stocks from these two regions may extend over a wider oceanic range than noted above. Based on rates of Triaenophorus infection, maturing Bristol Bay sockeye comprised a very large proportion of the samples taken in June in the eastern Bering Sea (at least to 175° W in 1957, to 170° W in 1958 and to 180° in 1959); they predominated in the samples from immediately south of the Aleutians from 169°39' W to 175° E in late May and early June 1959, and they comprised a large proportion of the samples taken in the northwestern part of the Gulf of Alaska (at 55° N, 155° W) in the first half of June (in 1958 and 1959). In the northern part of the Gulf of Alaska, in late May and the first half of June, the proportion of maturing Bristol Bay sockeye diminished towards the east; at 141° W, in 1959, they were absent or scarce. This decrease in the proportion of Bristol Bay sockeye was probably due to the presence of sockeye having originated in the rivers tributary to the Gulf of Alaska and the northeast Pacific. In the northwest Pacific from 175° E to the east coast of Kamchatka maturing Bristol Bay sockeye were very scarce or absent in all years. It appears that the sockeye in this region were principally of Kamchatkan origin. Samples of maturing sockeye from the western Bering Sea in May or June generally were scanty, but in the available samples from about 180° and westward in 1958 it appears unlikely that Bristol Bay sockeye could have predominated, and at 171° E in 1959 Bristol Bay sockeye formed a minor proportion of the samples. The predominant group of sockeye in these samples had probably originated in Kamchatkan rivers. (Auth.)

7318. Mosher, Kenneth H. (Bur. Comm. Fish., Seattle, Washington). 1963. RACIAL ANALYSIS OF RED SALMON BY MEANS OF SCALES. International North Pacific Fish. Comm. Bull. 11. 31-56. Illus. Maps; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32066. 1964.

Two methods of determining the continental origin of red (sockeye) salmon in the central North Pacific-Bering Sea area--using age groups and scale characters--show that North American and Asian red salmon intermingled over a broad area in 1956 and 1957. Scale characters indicated that western Alaska salmon predominated from Alaska

to the area between longitudes 175° E and 178° E, north of the Aleutians, in 1957 and were also predominant within that area in 1956. The scale characters indicated that Asian salmon predominated westward from the area between longitudes 175° E and 178° E, north of the Aleutians, in 1957. No samples were taken there in 1956. South of the Aleutians, scale characters indicated that Asian salmon predominated from Kamchatka to at least longitude 175° E in 1957, and western Alaska salmon predominated in the one sample taken east of 175° E at longitude 175° W. Samples taken in 1956 indicated a predominance of Asian red salmon within the same general area, south of the Aleutians, in which they were dominant in 1957. (Auth.)

7319. Ninua, N. Sh. 1960. LAKE TABISKURI WHITEFISH: BIOLOGY AND CONDITION OF THE STOCK FROM 1958 DATA. (TABISKURSKII SIG BIOLOGIYA I SOSTOYANIE ZAPASOV (PO MATERIALAM 1958 GODS).) Tr. Nauchn.-Issled. Rybokhoz. Sta. Gruzii 5: 38-53; (Georgian summ.) Referat. Zhur., Biol., 1963, No. 5I23; (Translation) Biological Abstracts, Vol. 45, No. 8, Abst. No. 32067. 1964.

Sizes of whitefish (Coregonus) taken in commercial catches in 1958 in Lake Tabiskuri (Georgia) varied from 15 to 45 cm, ages being 1+, 2+, and 3+; older age groups constituted an insignificant part of the catch. Lake Tabiskuri whitefish grow faster in length and weight than Lake Ladoga whitefish, but more slowly than Lake Sevan whitefish. Stomachs contained chiefly leeches, the remainder being Cladocera, Copepoda, caddis flies, fresh-water shrimp, and the alga Nostoc. Index of fullness of the stomach (calculated as a percentage of body weight was: 141.1 in June; 248.9 in July; 256.2 in August; 229.3 in October. The condition factor fluctuated from 0.5 to 2.9. Egg abundance was estimated at from 2,058 to 19,522 (average 7,700) eggs. Coefficient of maturation was 2.0 in June, and rose to 8.3 by October.

7320. Slack, H. D. (Zool. Dept., Univ. Glasgow, Glasgow, Scotland). 1962. THE MATURATION OF CHINESE GRASS-CARP (CTENOPHARYNGODON IDELLUS C. ET V.) IN TROPICAL WATERS. Malayan Agric. Jour. 43(4): 299-328. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32079. 1964.

The further growth of 2 cultures of grass-carp in tropical ponds already reported is described and reasons adduced for changes in growth rates. Both cultures were found to reach an advanced stage of gonad maturation at an earlier age than that of grass-carp in their normal environment; males attained complete maturity and females closely approached ovulation in static ponds. A flow of water passed through a pond stimulated these fish to activity resembling pre-spawning behavior although spawning was not achieved. (Auth.)

7321. Sundararaj, B. I., and M. R. N. Prasad (Dept. Zool. Delhi Univ., Delhi, India). 1963. ROLE OF SACCUS VASCULOSUS IN TELEOSTS: A NEW INTERPRETATION. Naturwissenschaften 50(9): 362-363; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32391. 1964.

Starvation experiments indicate that glycogen in the coronet cells of the saccus vasculosus depends on blood-glucose levels and, thus, on the nutritional condition of the fish. Glycogen in the apical protrusion passes into the globules and may be released into the lumen as glucose. The saccus vasculosus is a source of glucose to the brain and the cerebrospinal fluid. (J. G.)

7322. Robertson, O. H., S. Hane, B. C. Wexler (Stanford Univ., Dept. Biol. Sci., Stanford, California), and A. P. Rinfret. 1963. THE EFFECT OF HYDROCORTISONE ON IMMATURE RAINBOW TROUT (SALMO GAIRDNERI). Gen. and Comp. Endocrinol. 3(4): 422-436. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32868. 1964.

With the purpose of securing further information concerning the role of the high levels of plasma 17-hydroxycorticosteroids (17-OHCS) in the causation of degenerative changes occurring in spawning Pacific salmon, hydrocortisone in cholesterol pellets was administered to sexually immature, starving rainbow trout. The hormone was released continuously for a period of about 5 weeks from the intraperitoneally-implanted pellets and produced concentrations of 17-OHCS in the trout blood similar to those found in sexually mature salmon and steelhead trout. The fish lost weight rapidly, developed infections of the skin, and in the case of lethal doses, died usually in 5 to 9 weeks. Death occurred much more rapidly and with smaller doses of the corticoid when the water temperature was raised from 55° F (13° C, the usual temperature) to 63° F (17° C). Examination of the tissues showed histological changes which, with few exceptions, were similar to those occurring in spawning salmon. Atrophic and deteriorative alterations were as marked in most of the organs as those present in salmon. Hyperglycemia was accompanied by hyperplasia of the beta cells of the islets of Langerhans. Control starved trout showed no tissue changes other than slight atrophy in certain of the internal organs. However, certain other trout, when starved for prolonged periods of time beyond the limits of the experiments, did show many of the degenerative alterations present in the corticoid-treated fish. The bearing of these experimental findings on the naturally occurring deterioration of the salmon is discussed. (Authors)

7323. Fontaine, Yves A. (Mus. Hist. Nat., Paris, France), and Peter G. Condliffe. 1963. PURIFICATION OF THE THYROTROPHIC HORMONE OF A TELEOST (THE EEL). PARALLEL BETWEEN THE ZOOLOGICAL SPECIFICITY OF THIS HORMONE AND SOME PHYSICOCHEMICAL CHARACTERISTICS. (PURIFICATION DE L'HORMONE THYRÉOTROPE D'UN TÉLÉOSTÉEN (L'ANGUILLE). PARALLÉLE ENTRE LA SPÉCIFICITÉ ZOOLOGIQUE DE CETTE HORMONE ET QUELQUES-UNS

DE SES CARACTÈRES PHYSICOCHIMIQUES.) Bull. Soc. Chim. Biol. 45(7/8): 681-693. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32954. 1964.

It has been shown previously that crude extracts of teleost pituitaries, capable of stimulating the teleost thyroid, has no effect on the thyroid of mammals; this zoological specificity suggested the existence of physico-chemical differences between the TSH of various origins. The factor from eel pituitaries possessing thyrotropic activity towards teleost has been partially purified by filtration on Sephadex gels and chromatography on CMC and DEAEC. In the course of purification, this factor behaves like a protein with physico-chemical properties analogous to those of mammalian TSH. It has been possible to achieve a degree of purification similar to that obtained in the case of mammals. The final product, like crude pituitary extracts, is inactive on mammals at doses which stimulate the thyroid of teleosts. Several of its physicochemical properties have been determined and compared with those of mammalian TSH; molecular size is of the same order, probably a little larger for eel TSH. Analysis of amino-acids shows some important differences, particularly a low relative cystine and amino-sugar content of eel TSH. The hypothesis of a relation between these facts and the zoological specificity of the teleost hormone is proposed. (Authors)

7324. Sawyer, Wilbur H., and Grace E. Pickford (Columbia Univ., Coll. Physicians and Surg., New York, N. Y.). 1963. NEUROHYPOPHYSEAL PRINCIPLES OF FUNDULUS HETEROCLITUS: CHARACTERISTICS AND SEASONAL CHANGES. Gen. and Comp. Endocrinol. 3(4): 439-445. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32967. 1964.

Pharmacological and chromatographic characteristics of pituitary extracts from Fundulus heteroclitus are consistent with the assumption that they contain the same two active principles that have been identified in other teleost fishes. These are arginine vasotocin and the teleost oxytocin-like principle, 4-serine, 8-isoleucine oxytocin. The oxytocin-like principle is undetectable in female pituitaries taken during the reproductive season in June, although it is present in male pituitaries taken at the same time and in both female and male pituitaries taken in September. This suggests that the teleost oxytocin-like principle may participate in the regulation of reproduction in this species. (Authors)

7325. Sawyer, Wilbur H., and H. B. van Dyke (Columbia Univ. Coll. Physicians and Surg., New York, N. Y.). 1963. ISOLATION OF THE OXYTOCIN-LIKE PITUITARY PRINCIPLE OF A TELEOST FISH (POLLACHIUS VIRENS) AND COMPARISON OF ITS PROPERTIES WITH THOSE OF SYNTHETIC 4-SERINE, 8-ISOLEUCINE OXYTOCIN. Endocrinology 73(3): 394-396; Biological Abstracts, Vol. 45, No. 8, Abst. No. 32968. 1964.

The oxytocin-like principle in the pollock pituitary has been purified and compared pharmacologically to synthetic 4-serine, 8-isoleucine oxytocin. The close correspondence between the properties of the natural and synthetic peptides strongly confirms the belief that they are identical. (Authors)

7326. Tsukuda, Hiroko. 1961. TEMPERATURE ACCLIMATIZATION ON DIFFERENT ORGANIZATION LEVELS IN FISHES. Jour. Biol. Osaka City Univ. 12: 15-45. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 33313. 1964.

With fish acclimated to 18°, 23°, and 28° of a thermophilic species Lebistes reticulatus and a eurythermal species Oryzias latipes, the effects of temperature acclimatization produced were compared among different levels of organization. Both heat and cold coma temperatures, determined by warming and cooling at a constant rate of 0.5° per minute, rise with rising acclimation temperature, the change being much greater in Oryzias. Lebistes is pronouncedly more susceptible to cold than Oryzias. The heat coma temperature of the latter is higher when acclimated to 28° and 23° but appreciably lower when acclimated to 18°. The temperature-log frequency curves of respiratory movement and heart beating in and outside the body determined by changing temperature at a constant rate of 0.5° per minute, are divided by critical temperatures, such as the upper and lower normal limits, yielding temperatures and stop temperatures, into the normal, supra-normal, subnormal, upper and lower dropping phases. Various effects of acclimatization are appreciated more positively and consistently in the adaptive shifts of these critical temperatures than in the compensatory changes in the frequency within the normal temperature range. Such effects of acclimatization as shown in the temperature tolerance of the functions which are under the direct control of the central nervous system, such as fin movement and respiratory movement, are also acknowledged in the functions on lower levels of organization differing in the controlling influence of the central nervous system. Some similarity between the behaviors of coma temperatures and those of the stop temperatures of respiratory movement suggests parallel paralyzing effects of heat or cold on the nervous mechanisms controlling fin movement and those controlling respiratory movement. The activity of the heart in situ appears to be associated closely with respiratory movement. Though the isolated heart shows the clearcut effects of temperature acclimatization, its behaviors at high temperatures are considerably different from those of the heart in situ. The isolated heart is more tolerant of heat than the heart in situ in Lebistes and vice versa in Oryzias. (Author)

7327. Armstrong, Philip B. 1963. STAGES IN THE DEVELOPMENT OF ICTALURUS NEBULOSUS. (Illus. by Julia Swope Child.) 8p. text; 16 plates. Syracuse University Press: Syracuse 10, New York. Pr. $4.95; Biological Abstracts, Vol. 45, No. 8, Abst. No. 33468. 1964.

The embryological development of the Ictalurus nebulosus, the brown bullhead or horned pout, is

presented. The bullhead is distributed generally throughout eastern and central United States as well as having been successfully introduced on the west coast of the States and several European and Far Eastern countries. The life history, ecology and laboratory conditions for raising the bullhead are discussed. There are 16 plates, on which are drawn the stages in the embryological development through stage 53. The plates are printed on heavy cardboard and, thus, will be valuable as visual aids in classroom and laboratory. (E. M. Z.)

7328. Bonham, Kelshaw, and Arthur D. Welander (Lab. Radiation Biol., Univ. Washington, Seattle). 1963. INCREASE IN RADIORESISTANCE OF FISH TO LETHAL DOSES WITH ADVANCING EMBRYONIC DEVELOPMENT. In: Radioecology. Proceedings of the First National Symposium on Radioecology. Reinhold Publishing Corporation: New York 22. pp. 353-358. Illus.; Biological Abstracts, Vol. 45, No. 8, Abst. No. 33475. 1964.

Experimental data and analysis of published results indicate that the radioresistance of the embryos of fishes and amphibia increases with advancing development in a way that may be expressed mathematically. Eggs of silver salmon were X-irradiated in 23 stages of development randomly selected from one-cell to late-eyed stage, at each stage using seven dosages incremented by a factor of about two. Lethal dose-50's at hatching and at 150 days postfertilization were both calculated and estimated from graphs. The regression of log lethal dose-50 in roentgens upon log percentage of incubation attained at time of irradiation was computed at both hatching ($Y = 240\ X^{0.42}$) and at 150 days ($Y = 125\ X^{0.33}$). These regression coefficients (the exponents of X) had confidence limits determined by $t.05s_b = 0.194$ and 0.188, with 18 and 19 degrees of freedom, respectively. The regressions represent general trends rather than the most sensitive stage. Estimates from the literature give similar relationships for rainbow trout, Fundulus and Misgurnus, although the regression for Misgurnus was non-significant. Amphibian radioresistance increased very slowly from fertilization to neurulation, and then sharply from neurulation almost to metamorphosis. (Authors)

7329. Maroń, K. (Dept. Exptl. Zool., Polish Acad. Sci., Craców, Poland). 1963. ENDBRAIN REGENERATION IN LEBISTES RETICULATUS. Folia Biol. (Warsaw) 11(1): 3-10. Illus.; (Russian and Polish summ.) Biological Abstracts, Vol. 45, No. 8, Abst. No. 33611. 1964.

The telencephalon was removed in 4-day-old fishes, and the process of regeneration was followed histologically. Ependyma cells are the main component in brain regenerates; complete regeneration occurs within 60 - 120 days. (A. P.)

7330. Amos, Murray H., Raymond E. Anas, and Roger E. Pearson (Bur. Comm. Fish., Seattle, Washington). 1963. USE OF A DISCRIMINANT FUNCTION IN THE MORPHOLOGICAL SEPARATION OF ASIAN AND NORTH AMERICAN RACES OF PINK SALMON, ONCORHYNCHUS GORBUSCHA (WALBAUM). Internatl. N. Pacific Fish. Comm. Bull. 11. 73-100. Illus. Maps; Biological Abstracts, Vol. 45, No. 8, Abst. No. 35588. 1964.

Pink salmon (Oncorhynchus gorbuscha) collected from representative North American and Asian areas in 1957 were studied to see how effectively morphological characters would separate continental stocks. A discriminant function was computed using three morphological characters and the Karaginskii and Kodiak-Cook Inlet samples as continental morphotypes. Applying this function, North American pink salmon populations from Kodiak Island and eastward were well separated from the Asian morphotype. Indications were that very few if any pink salmon from these areas were present in the high-seas samples examined. A predominance of pink salmon of Karaginskii morphotype were found in samples taken as far east as 175° W longitude. (Authors)

7331. McAllister, D. E. (Natl. Mus. Canada, Ottawa, Ontario, Canada). 1963. FISH REMAINS FROM A 600-YEAR-OLD YUKON ARCHAEOLOGICAL SITE. Can. Field-Nat. 77(4): 232; Biological Abstracts, Vol. 45, No. 8, Abst. No. 35596. 1964.

Remains attributable to Esox lucius, Salvelinus namaycush and Lota lota were found in Bennet Lake cultural phase deposits at the Little Arm site, Kulane Lake. The carbon date of the site is 1000-1800 A. D. (Auth.)

7332. Parker, Henry Lee. 1963. NATURAL HISTORY AND CHARACTERISTICS OF PIMEPHALES VIGILAX (BAIRD AND GIRARD). Dissert. Abst. 24(4): 1764; Biological Abstracts, Vol. 45, No. 8, Abst. No. 35604. 1964.

7333. Rothschild, Brian James. 1963. THE LIFE HISTORY OF THE ALEWIFE, ALOSA PSEUDOHARENGUS (WILSON), IN CAYUGA LAKE, NEW YORK. Dissert. Abst. 24(3): 1302; Biological Abstracts, Vol. 45, No. 8, Abst. No. 35606. 1964.

7334. Savvaitova, K. A. (Dept. Ichthyol., Moscow State Univ., Moscow, USSR). 1963. REGARDING PROBLEMS ON FEASIBILITY OF USING CERTAIN PHYSIOLOGICAL INDICATORS IN TAXONOMY OF FISH. (K VOPROSU O VOZMOZHNOSTI PRIMENENIYA NEKOTORYKH FIZIOLOGICHESKIKH POKAZATELEI V SISTEMATIKE RYB.) Vest. Mosk. Univ. Ser. Biol., Pochvovedenie 18(3): 25-28; Biological Abstracts, Vol. 45, No. 8, Abst. No. 35608. 1964.

The study involves an analysis of intraspecific varieties of Salvelinus alpinus (L.) from Kamchatka, utilizing indicators of some fat metabolism characteristics, hemoglobin content and blood composition. Condition factors (after Tester, as differentiated for species by D. A. Shubnikov) for males and females between June and October 1959 are tabulated in relation to migratory (59 specimens), limnetic (35), and fluvio-lacustrine (398) varieties. Another

table presents hemoglobin % (after Sali), erythrocyte and leucocyte counts (Thomas counting chamber, method after G. G. Golodets) for the 3 varieties of S. alpinus. The condition factor is classified as relatively stable, hemoglobin content and blood composition are strongly variable. Variability patterns of these factors are governed by the mode of life of the sp. and its interrelations with the environment. Mean values and extent of variability are specific for the sp. as a whole and its intraspecific varieties. Bibliography includes 24 titles. (B. Le B.)

7335. Schontz, Charles Jack. 1963. THE EFFECTS OF ALTITUDE AND LATITUDE ON THE MORPHOMETRY, MERISTICS, GROWTH AND FECUNDITY OF THE EASTERN BLACKNOSE DACE, RHINICHTHYS ATRATULUS ATRATULUS (HERMANN). Dissert. Abst. 24(3): 1303; Biological Abstracts, Vol. 45, No. 8, Abst. No. 35609. 1964.

7336. Straus, Lorna P. (Dept. Anat., Univ. of Chicago, Chicago, Illinois). 1963. A STUDY OF THE FINE STRUCTURE OF THE SO-CALLED CHLORIDE CELL IN THE GILL OF THE GUPPY, LEBISTES RETICULATUS P. Physiol. Zool. 36(2): 183-198. Illus.; Biological Abstracts, Vol. 45, No. 9, Abst. No. 35944. 1964.

The so-called chloride cell is characterized by abundant mitochondria and a prominent agranular branching tubular endoplasmic reticulum. Some of the smooth-surfaced tubules of the endoplasmic reticulum are arranged in 2 patterns which thus far have not been described in any other cell type: closely packed parallel groups and net-like arrays. Tubules are frequently seen to be continuous with the cell membrane. A study of the short-term effects of changes in the external environment was undertaken in order to study further the role that has been suggested for this cell, that of chloride regulation as a part of the teleost osmoregulatory mechanism, and no significant morphological changes in the fine structure of the so-called chloride cell were found in response to ionic and other changes in the environment. It is suggested that the absence of morphological changes indicates that there is no direct relationship between the morphology of the cell and an osmoregulatory function. (Auth.)

7337. Timofeeva-Resovskaya, E. A. 1963. DISTRIBUTION OF RADIOISOTOPES BY BASIC COMPONENTS IN BODIES OF FRESH WATER. (RASPREDELENIE RADIOIZOTOPOV PO OSNOVNYM KOMONENTAM PRESNOVODNYKH VODOEMOV.) Tr. Inst. Biol. Ural'sk. Fil. Akad. Nauk SSSR 30. 1-78. Illus.; Referat. Zhur., Biol., 1963, No. 11D312; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36049. 1964.

General theory of biosphere, biogenoconeology, biogeocenologic research of bodies of water, and objectives of the present work are presented. The partition of radioisotopes between water, substrate, and biomass of water bodies, leads to their classification as hydrotropes, equitropes, pedotropes, or biotropes. The coefficient of accumulation (the ratio of radioisotope concentration in the organism and in water based on calculating the dry weight of the organism) of radioisotopes by fresh-water hydrobionst are given. Radioisotopes accumulate and reach a state of equilibrium in hydrobionts during 10-15 days (with the exception of Sr in mineralized tissues of mollusks and fish). Concentration of stable carriers 10^{-8}-10^{-14}M coefficients of accumulation do not depend on concentrations where physical and chemical forms of elements are stable in solution. Data is given on the coefficient of accumulation for 20 radioisotopes in 58 species of hydrobionts. Comparison is made of the coefficient of accumulation for several chemical analogs, the effect of groups of atoms on the coefficient of accumulation is shown, and specific accumulators are separated out. Information is given on radiostimulation and dynamics of growth rate of periphyton biomass, change of its structure while subject to the action of solutions of radioisotopes. Problems of deactivation of water in weakly-flowing bodies of water are discussed.

7338. Romashov, D. D., V. N. Belyayeva, K. A. Golovinskaya, and A. A. Prokof'yeva-Bel'govskaya (Inst. Biol. Phys., Acad. Sci. USSR, Moscow, USSR). 1963. RADIATION INJURIES IN FISH. English Absts. Soviet Bloc and Mainland China Tech. Jour. Ser. VI. Bio-Sci. 62-11,145(26): n. p. (Abstract only.); Biological Abstracts, Vol. 45, No. 9, Abst. No. 36107. 1964.

Fish can tolerate much higher doses of radiation than mammals, the minimum lethal dose may be >2000 r. 300, and particularly 600 or 1,000 r delay the development of the sex glands without impairing the viability of young fish. Up to 2,000 - 6,000 r, the degree of injury is proportional to the dose, but at much higher doses the nucleus of the spermatozoon becomes inactive and the injuries are less marked ("Hertwig effect"). Very high doses (100,000 r and more) lead to the development of numerous degenerated haploid individuals possessing only the maternal set of chromosomes. In addition, however, a few normally growing individuals can be found; these are "diploid gynogenetic" individuals, i. e. owing to a further division they have 2 sets of chromosomes, both of maternal origin. By exposure to "cold shock," the proportion of these diploid gynogenetic individuals is increased to 15 - 60% of the spawn. The fertilized spawn is kept 3 hours at a temperature between 1 and 3° C, beginning precisely 10 minutes after fertilization. The damage caused in the chromosomes by radiation can be followed up through a number of cell divisions in the course of embryogenesis, to the larval stage or until the age of 25 days. In young fish embryos the dicentrical chromosomes and chromatids are unstable and serve as a source of intracellular fragments. The cycle of chromosome- and chromatid-bridges becomes relatively stable only in the later gastrula stage. (Authors)

7339. Ruwet, Jean-Claude (Univ. Liege, Leige, Belgium). 1963. OBSERVATIONS ON THE SEXUAL

BEHAVIOR OF TILAPIA MACROCHIR BLGR. (PISCES: CICHLIDAE) IN THE RESERVOIR OF LUFIRA (KATANGA). (OBSERVATIONS SUR LE COMPORTEMENT SEXUEL DE TILAPIA MACROCHIR BLGR. (PISCES: CICHLIDAE) AU LAC DE RETENUE DE LA LUFIRA (KATANGA).) Behaviour 20(3/4): 242-250; (English summ.) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36145. 1964.

Mwadingusha Lake contains important spawning grounds of Tilapia macrochir Blgr. One, with a population of 200 male individuals, lies at the foot of the dam wall and offers exceptionally good conditions for observation from the top of the dam. These data are important because of the scarcity of observations available on large numbers of fish in an open and free habitat. The male selects the site of the territory, builds the nest, and defends the territory. The union of the pair is fleeting. The eggs, about 15, and the milt are immediately picked up and taken away by the female. The actions, from the arrival of the female to her departure with the fertilized eggs take 50-60 seconds. By their presence alone, all the inhabitants of the spawning ground, including individuals of other species and juveniles of T. macrochir, can take part in the distribution of females, for by accidentally disrupting the mates, females may leave one nest for another. Successive polygamy by the males and successive polyandry by the females, the general rule, ensures a thorough mixing of the population. One female usually holds in her mouth batches of eggs fertilized by different males. After spawning has been completed the males stay on their territory while the females move from the spawning grounds. (G. N. L.)

7340. Dolzhenko, M. P., and V. P. Vlasov. 1961. MEASURES FOR INCREASING FISH PRODUCTIVITY AND IMPROVING THE SPECIES COMPOSITION OF FISH IN SOME SMALL LAKES IN THE ALTAI DISTRICT. (MEROPRIYATIYA PO POVYSHENIYU RYBOPRODUKTIVNOSTI I ULUCHSHENIYU VIDOVOGO SOSTAVA RYB V NEKOTORYKH MALYKH OZERAKH ALTAISKOGO KRAYA.) Nauchn.-Tekh. Byul. Gos. Nauchn. Inst. Ozernogo i Rechnogo Rybn. Khoz. 13/14. 46-48; Referat. Zhur., Biol., 1963, No. 6I91; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36289. 1964.

Lake Srostinsk (area 5000 ha, depth to 2 m) had the best prospects. The fish of the lake consists of Carassius, Tinca tinca, and Phoxinus percnurus. For increasing the fish productivity of the lake, it is necessary to raise the water level and stock it with Abramis brama and Esox lucius. In the Mostovoe-Chernakovo system of lakes, lake Mostovoe is suitable for the annual Cyprinus carpio feeding migration. Coregonus albula and A. brama could be supplementary fishes.

7341. Eggert, V. B. 1960. WHITEFISH CULTURE AT "ROPSHA." (VYRASHCHIVANIE SIGOVYKH V ROPSHE.) Nauchn.-Tekh. Byul. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 12. 35-37; Referat. Zhur., Biol., 1962, No. 9I70; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36290. 1964.

This paper reports work done in 1960 at the Central Electric Power Plant "Ropsha." Whitefish larvae were planted in the ponds on the 3rd or 4th day after hatching and were reared for a period of 2 months without any pond drainage whatsoever. Ponds set aside for rearing the larvae are filled in autumn. This ensures an abundant growth of plankton prior to stocking. Minimum (351g) and maximum (620g) weights of Coregonus peled yearlings in feeding ponds at harvest time are given. Sexually mature C. peled yearlings were transferred to pond tanks and roe was collected from them. Immature fish were transferred to the wintering pond to provide a breeding stock in 1961.

7342. Gaylor, J., and A. Houser. 1962. THREE YEARS' RESULTS WITH SILVEX FOR AQUATIC PLANT CONTROL IN OKLAHOMA. Down to Earth 18(3): 2-4; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36292. 1964.

The most troublesome weeds in Oklahoma ponds are: Najas guadalupensis, Ceratophyllum demersum and Potamogeton repens. Silvex (2, 4, 5-trichlorophenoxy propionic acid) applied at the rate of 100-150 pounds per surface acre gave complete control of the latter two species for a 2-year period and of the first species for a somewhat shorter time. Fish were not injured by the treatment. (V. R. G.)

7343. Golovkov, G. A., and T. I. Privol'nev. 1961. A NEW METHOD OF DEGUMMING COREGONUS PELED SPAWN. (NOVYI METOD OBESKLEIVANIYA IKRY PELYADI.) Nauchn.-Tekh. Byul. Gos. Nauchn. Inst. Ozernogo i Rechnogo Rybn. Khoz. 13/14. 118-119; Referat. Zhur., Biol., 1963, No. 6I110; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36293. 1964.

With an addition to the water (pH about 8) of 5 drops of concentrated HCl, the active reaction was reduced to 7 - 7.1. When the spawn was washed with the solution, gumminess vanished after 50-60 minutes. The highest percentage of live spawn was observed in experiments with application of HCl solutions (90.7%) and swampy water (93.2%).

7344. Gorbman, Aubrey (Dept. Zool. Barnard Coll., New York, N. Y.), and Miriam S. James. 1963. AN EXPLORATORY STUDY OF RADIATION DAMAGE IN THE THYROIDS OF CORAL REEF FISHES FROM THE ENIWETOK ATOLL. In: Radioecology. Proceedings of the First National Symposium on Radioecology. Reinhold Publishing Corporation: New York 22. pp. 385-399. Illus.; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36294. 1964.

Three series of coral reef fishes, totaling 175 specimens and representing 79 species and 25 families, were collected at Eniwetok Atoll in the Marshall Islands at 1-month and 8-month intervals after a nuclear explosion. Two of the series included fishes from both a "near" and a "distant" site within the atoll, relative to the explosions. Serial sections of the thyroid regions revealed varying amounts of necrotic alteration in many specimens,

suggesting a thyrotoxic level of I-131 in the environment. Using a rough scoring system, it was possible to estimate the relative degree and extent of thyroid damage and to express it numerically for comparison with other individuals. Histopathologic changes similar to those described for laboratory teleosts injected with I-131 were encountered in thyroids from all collections, although more pronounced in the 2nd and 3rd. While more species in the "near" series showed distinctly a more severe level of thyroid damage, individual members of a few families from "distant" collections were affected in some instances, including Acanthuridae, Ballistidae, Blenniidae, and Mullidae. The evidence suggests a rapid distribution by water currents from the original area of concentrated fallout. Thyroid injury appeared to be more closely correlated with diet than with location of food, time interval after explosion, or taxonomic position. Highest injury scores were recorded for fishes of trophic level 2 (herbivores) and the incidental herbivores of other levels. Species which habitually consumed lamellibranch molluscs showed greater thyroid necrosis than other carnivores of trophic level 3. Fishes of level 4, except for 2 specimens, were least affected. (Authors)

7345. Libosvarsky, J. (Lab. Vertebr. Zool., Czechoslavakian Acad. Sci., Brno, Czechoslavakia.) 1962. APPLICATION OF DE LURY METHOD IN ESTIMATING THE WEIGHT OF FISH STOCK IN SMALL STREAMS. Internatl. Rev. Ges. Hydrobiol. 47(4): 515-521; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36298. 1964.

The catchable fraction of the fish population present in a small stream is determined as follows: in a blocked reach of a stream, 3 fishing efforts are carried out by electro-fishing at certain intervals, and weights of successive catches are determined. The weight of fish stock is calculated by De Lury's formula $\hat{N}_0 = \frac{C}{1-b'}$, where $\hat{N}_0$ = initial population size, C = total catch and b' = the antilogarithm of the regression coefficient of linear regression of logarithms of the catches on cumulative effort. Successive fishing efforts are considered as units of fishing efforts. First, a regression coefficient is calculated based on the correlation of logarithms of weights of successive catches and orders of efforts, and the t value is determined. Regression coefficients are converted to antilogarithms, which are used in the equation. The proposed method is substantiated and practical examples of calculation are given. (C. C. D.)

7346. Mackenzie, C. R. (City Hlth. Dept., Durban, Union S. Africa), and G. D. Campbell. 1963. HYGIENIC EVALUATION OF THE FOOD FISHES TILAPIA MELANOPLEURA AND TILAPIA MOSSAMBICA NURTURED IN SEWAGE EFFLUENT. S. African Med. Jour. 37(38): 968; Biological Absts. Vol. 45, No. 9, Abst. No. 36299. 1964.

Bacteriological examination was made upon fish nurtured in the 2nd of the 3 maturation ponds of the sewage plant of the Kwa Mashu Township near Durban. Portions of fish of the species Tilapia melanopleura and T. mossambica that were examined were the skin and scales, gills, intestinal contents, and flesh. No significantly pathogenic organisms were found. This shows these fish entirely safe for human consumption when properly cooked, in spite of the fact that they grew during periods when settled sewage by-passed the plant directly into the pond. To people eating the fish raw or semi-cooked there would appear to be no danger under present conditions. There is almost certainly wide scope for the application of sewage effluent to fresh-water fish farming in this country. (Authors)

7347. Marti, Yu. Yu. 1962. SOME SIMILARITIES AND DIFFERENCES IN LIVING CONDITIONS OF BOREAL FISH SPECIES OF THE NORTHEASTERN REGIONS OF THE ATLANTIC. (NEKOTORYE SKHODSTVA I RAZLICHIYA V USLOVIYAKH SUSHCHESTVOVANIYA BOREAL'NYKH VIDOV RYB V SEVERO-VOSTOCHNYKH I SEVERO-ZAPADNYKH RAIONAKH ATLANTIKI.) In: Sovetskie rybokhozyaistvannye issledovaniya v severo-zapadnoi chasti Atlanticheskogo okeana. (Soviet fisheries research in the northwestern Atlantic.) Rybn. Khoz.: Moscow. 57-68; (English summ.) Referat. Zhur., Biol., 1963, No. 16I156; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36300. 1964.

Substantial differences among adaptive characteristics to living conditions of herring, cod, haddock, and redfish of the northwestern and northeastern regions are the result of peculiarities of migration cycles that are connected with prevailing currents. In the Norwegian, Greenland, and Barents Seas there are substantial drift migrations of larvae and fry of cod, herring, haddock, pollock and redfish from spawning to feeding grounds. In Newfoundland shallows the drift migrations are weaker. Eel larvae drift with the Gulf stream to European coasts. The return migration of maturing fish can occur only in those regions where there is a drift of young fish; such migrations were observed in northeastern regions for all species which reproduce in the southwestern parts of their range. The vast area of the boreal zone in the northeastern Atlantic leads to the formation of large and protracted feeding migrations. In the western zone of the Atlantic the migrations were limited to coasts in summer, and to abyssal waters in fall and winter. Race-formation processes are more pronounced in the western Atlantic. The higher fish productivity of the northeastern Atlantic is connected with the large stocks of herring, cod, and haddock. The redfish stock was found to be larger in western regions. Bibliography includes 17 references.

7348. Petrenko, L. A. 1961. BEHAVIOR IN A RIVER OF YOUNG SALMO SALAR REARED IN TANKS AND PONDS. (POVEDENIE V REKE MOLODI SEMGI, VYRASHCHENNOI V BASSEINAKH I PRUDAKH.) Nauchn.-Tekh. Byul. Gos. Nauchn. Inst. Ozernogo i Rechnogo Rybn. Khoz. 13/14. 66-68; Referat. Zhur., Biol., 1963, No. 6I104; (Translation) Biological Abstracts, Vol. 45, No.

9, Abst. No. 36306. 1964.

Data are given on the transportation and behavior of young Salmo salar bred in ponds, after their release into a river. Basically, the young concentrated in the places of release. They were less active in spring and fall.

7349. Poulson, Thompson L. (Dept. Biol., Yale Univ., New Haven, Connecticut). 1963. LIFE HISTORY AND THE CONTROL OF POPULATION SIZE IN AMBLYOPSID FISHES. In: Convention of the National Speleological Society, Mt. Lake, Virginia, 1963. NSS News Natl. Speleol. Soc. 21(10): 159; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36310. 1964.

Abstract only available.

7350. Rabe, Frederih W., III. 1963. EFFECT OF FERTILIZATION ON FOUR ALPINE LAKES IN THE UINTA MOUNTAINS. Dissert. Abst. 24(4): 1765-1766; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36311. 1964.

7351. Shterman, L. Ya. 1960. BLOOD OSMOTIC PRESSURE IN WINTERING CARP FINGERLINGS. (OSMOTICHESKOE DAVLENIE KROVI U SEGOLETOK KARPA VO VREMYA ZIMOVSKI.) Nauchn.-Tekh. Byul. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 12. 38-40; Referat. Zhur., Biol., 1963, No. 5I53; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36315. 1964.

Blood osmotic pressure in 60 fingerling hybrids of pond carp and eastern carp (Cyprinus carpio haematopterus) wintering in live-fish tanks in a pond was determined at monthly intervals at a water temperature of 1-1.5° C. In October-November the blood osmotic pressure had risen from -0.550° to -0.600°; by February it returned to normal; at the end of March-April, it fell to -0.375°, representing a 38% decrease compared to the normal level. Highest fish mortality occurred at this point. The higher the autumn blood osmotic pressure value, the less will be its minimum winter value. Good nutrition in autumn is conducive to higher blood pressure and ensures satisfactory wintering. High osmotic pressure in carp during autumn serves as an indicator of good preparedness for wintering.

7352. Spanovskaya, V. D. 1963. SOME CHARACTERISTICS OF THE FISH FAUNA OF THE UCHINSKOYE RESERVOIR. (IKHTIOFAUNA UCHINSKOGO VODOKHRANILISHCHA I EE OSOBENNOSTI.) In: Uchinskoye y Mozhaiskoe vodokhranilishcha. (Uchinsk and Mozhaisk reservoirs.) Mosk. Univ.: Moscow. 269-310; Referat. Zhur., Biol., 1963, No. 16I79; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36317. 1964.

Changes in the fish fauna of Uchinskoye Reservoir, which occurred over a period of 20 years, resulted in the disappearance of rheophilic fishes and their replacement with limnophilic ones. A sharp rise occurred in the number of roach (Rutilus rutilus), perch (Perca fluviatilis), ruffe (Acerina cernua), and bleak (Culter alburnus). After 1945, mirror carp, wild carp (Cyprinus carpio), sterlet (Acipenser ruthenus), "ripus" (Coregonus albula ladogensis), and stint (Osmerus e. eperlanus) were released in the reservoir. In the 40's, growth rate of non-predatory fishes, with the exception of stint, was low due to lack of coastal vegetation--the feeding place of young fish. Cladocerans, molluscs, and plants were almost completely absent from the food of the fishes. Towards the 50's the number of plants and animals inhabiting the coastal beds increased, and Dreissena penetrated into the reservoir. With improvement in the feeding conditions, linear and weight growth of all species of young fishes, as well as of adult roach and bleak, significantly increased. Fecundity of roach and bleak rose. Growth rate of young bream and zander is low due to scarcity of food. The food supply of young zander and bream can be augmented by reducing the number of perch and ruffe, and also by introducing new food invertebrates. Because Dreissena disrupt the normal functioning of hydraulic works, it is essential to reduce their number by maintaining the number of roach of older age groups. For restoration of the abundance of valuable commercial fishes, it is essential to suspend their capture for a number of years and to protect them during their spawning season.

7353. Tets, V. I. 1961. DEGREE OF CONTAGION OF THE ULCEROUS FORM OF DROPSY. (O KONTAGIOZNOSTI YAZVENNOI FORMY KRASNUKHI.) Nauchn.-Tekh. Byul. Gos. Nauchn. Inst. Ozernogo i Rechnogo Rybn. Khoz. 13/14. 105-108; Referat. Zhur., Biol., 1963, No. 7I75; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36318. 1964.

Carp were subjected to infection with dropsy by injecting them with pathological material from fish suffering from an ulcerous form of that disease, and also by contact with fish having the ulcerous form. From the end of June to autumn, the experimental fish were not sick. Consequently, infectious dropsy in the ulcerous form is not contagious in summer.

7354. Tenney, Wilton R., and William S. Woolcott (Dept. of Biol., Univ. Richmond, Richmond, Va.). 1964. A COMPARISON OF THE RESPONSES OF SOME SPECIES OF FISHES TO THE TOXIC EFFECT OF THE BRYOZOAN, LOPHOPODELLA CARTERI (HYATT). Virginia Jour. Sci. 15(1): 16-20; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36322. 1964.

The homogenate of Lophopodella carteri, a fresh-water bryozoan, is toxic to fishes. Diluted extracts of crushed colonies were found to be lethal to 9 species. There were indications that the species varied in susceptibility to the poison, as did individuals within a species, and that concentration of the extracts was related to death times. Micropterus salmoides and Lepomis macrochirus were tested in an 8% extract and the difference between their mean death times was found to be statistically significant. White mice and tadpoles of Rana pipiens

were unaffected by the poison, as were specimens of several different invertebrate phyla. (Authors)

7355. Yandovskaya, N. I. 1961. RESULTS OF RAISING FINGERLING ATLANTIC SALMON IN PONDS. (O REZUL'TATAKH BASSEINOVOGO VYRASHCHIVANIYA SEGOLETOK SEMGI.) Nauchn.-Tekh. Byul. Gos. Nauchn.-Issled Inst. Ozernogo i Rechnogo Rybn. Khoz. 13/14. 58-61; Referat. Zhur., Biol., 1963, No. 5I83; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 36324. 1964.

Experimental rearing of salmon fingerlings was carried out at the Vygsk and Kandalaksha fish hatcheries by the method employed in the cultivation of Baltic salmon. For the first 3 to 5 days larvae were fed hard-boiled yolks (1 to 3 yolks per 50,000 larvae) 8 to 9 times per day. With the introduction of other food materials into the ration, the daily feeding rate rose to 10-15% of body weight. It was found that salmon fingerlings approach those of trout in size, growth-rate, and feeding activity at the stage of transition to mixed feeding. At a temperature increase of from 8 to 10° C the larvae exhibited positive reaction to light. In some hatcheries a considerable number of fry (20-30%) were found to differ from others in having smaller dimensions. These were highly susceptible to disease. The period of mixed feeding and change to the fingerling stage in experiments conducted at 12-15° C lasted from 15 to 20 days. Fingerlings were fed rations of 15 to 30% of their body weight, divided among 3 to 5 feedings per day.

7356. Sorvachev, K. F., and O. A. Medvedkina (Isotope Lab. Moscow State Univ., Moscow, USSR). 1963. NUCLEIC ACIDS IN CARP OFFSPRING BRED FROM HYPERIMMUNIZED PARENTS. (NUKLEINOVYE KISLOTY U POTOMSTVA KARPOV, POLUCHENNYKH OT GIPERIMMUNIZIROVANNYKH PROIZVODITELEI.) Vest. Mosk. Univ. Ser. Biol., Pochvovedenie 18(3): 29-34; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36391. 1964.

The study concerned itself with the content of nucleic acid in various organs of normal and immunized carp. The latter were 2-year-old offspring of breeders immunized against rubella between 1956 and 1961. Serum was analyzed electrophoretically. Content of DNA and RNA was found spectrophotometrically, their separation was after Schmidt and Tannhauser. Nucleotide structures for both were determined by using methodology after A. S. Spirin and A. N. Belozerskii (chromatography on paper with ultraviolet spectrophotometry). Tabulations are included for the nucleic acid content of spleen, liver and brain in experimental and control groups of carp, for nucleotide structure of DNA in liver, kidneys and gonads of both groups and nucleotide structure of RNA in the liver of carp from both groups. The latter is presented in a comparison to similar data for Labrus prasostictes, a bull, a rat, and a sea urchin. It is concluded that DNA in carp belongs to the AT type ($\frac{\text{adenine and thymine}}{\text{guanine and cytosine}} = 1.50\text{-}1.52$) and does not exhibit specificity for organs. RNA from carp liver belongs to the GC type ($\frac{\text{guanine cytosine}}{\text{adenine uracil}} = 1.51\text{-}1.54$). Nucleotide structures of DNA and RNA from offspring of hyperimmunized and unvaccinated carp do not differ significantly, but the DNA and RNA content in spleen and liver was found to be much higher in the former than in the latter. Bibliography includes 22 titles. (B. Le B.)

7357. Ito, Yuki, Tatsuzo Fujii, and Ryosaku Yoshioka (Gifu Med. Sch., Gifu, Japan). 1963. ON A PHOSPHOPROTEIN ISOLATED FROM TROUT EGG. Jour. Biochem. (Tokyo) 53(3): 242-243; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36406. 1964.

Matured eggs of Salmo irideus were extracted by homogenizing with bicarbonate buffer, pH 9.8 (ionic strength 0.2), and subjected to starch grain electrophoresis at pH 9.8 (bicarbonate buffer, ionic strength of 0.2), which separated phosphoprotein, simple proteins, and lipoproteins in the descending order of mobility towards anode. Yield of phosphoprotein was 6%. The phosphoprotein was homogeneous in ultracentrifuge (1.9 S. units) at pH 9.8, and contained 4% P and 14.8% N. Hydrolysis of the phosphoprotein by 6N HCl yielded glycine, alanine, serine, asparagine, glutamic acid, and an unidentified ninhydrin-pos. substance. (F. K. A.)

7358. Rumen, N. M. (Johns Hopkins University, Baltimore, Maryland). 1963. THE FORMATION OF TWO AND FOUR CHAIN MOLECULES BY SEA LAMPREY HEMOGLOBINS (PETROMYZON MARINUS) AND THEIR OXYGEN EQUILIBRIUM. In: 47th Annual meeting of the Federation of American Societies for Experimental Biology, 1963. Fed. Proc. 22(2 Pt. 1): 681; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36540. 1964.

Abstract only available.

7359. Reiser, Raymond (Texas Agric. Expt. Sta., College Station, Texas), Bernadette Stevenson, Mitsu Kayama, R. B. R. Choudhury, and D. W. Hood. 1963. THE INFLUENCE OF DIETARY FATTY ACIDS AND ENVIRONMENTAL TEMPERATURE ON THE FATTY ACID COMPOSITION OF TELEOST FISH. Jour. Amer. Oil Chem. Soc. 40 (10): 507-513. Illus.; Biological Abstracts, Vol. 45, No. 9, Abst. No. 36723. 1964.

Marine and fresh-water fish were depleted of tissue unsaturated fatty acids to various degrees and, subsequently, presented with linoleic and linolenic acids at different dietary levels, at different temperatures, with and without other dietary fat. Examination of the tissue fatty acids demonstrated that marine and fresh-water fish do not differ between themselves or from other classes of animals in the following basic mechanisms of deposition and interconversions of dietary fatty acids: The fish are readily depleted of tissue polyunsaturated fatty acids. Dietary linoleic and linolenic acids are deposited, the former to a greater degree than the latter. At high levels of linoleic or linolenic

acids in the diet there is no significant degree of their conversion to the longer chain more highly unsaturated acids typical of marine oils. At low levels of linoleic or linolenic acids in the tissues there is a significant, but slight, conversion to the longer chain acids at low environmental temperatures. The increase in the level of linoleic acid in tissue lipids which accompanies increases in the dietary levels, quickly tapers off above dietary levels of 5%. Temperature differences between 13 and 23 C had little or no influence on the deposition or interconversion of polyunsaturated acids. Dietary cottonseed oil, which contains cyclopropene fatty acids, produces an increase in tissue stearic acid in the fundulus. (Authors)

7360. Ziegler, Irmgard (Bot. Inst. Tech. Hochsch. Darmstadt, Darmstadt, W. Germany). 1963. TETRAHYDROPTERIN AND MELANOPHORE DIFFERENTIATION IN FISHES. (TETRAHYDROPTERIN UND MELANOPHOREN DIFFERENZIERUNG BEI FISCHEN.) Zeit. Naturforsch. 18b(7): 551-556. Illus. (English summ.); Biological Abstracts, Vol. 45, No. 9, Abst. No. 37342. 1964.

The pterins of adult fishes are located in special chromatophores, the "pterinophores," where they are bound to protein granules. In some cases the centers of these pterinophores also contain droplets of carotenoids. The pterins in the skin of adult fishes are metabolically inactive compounds like xanthopterin, which is shown for 5 different species of Crenilabrus. In the skin of newly hatched Crenilabrus, where melanophore differentiation and intensive melanin synthesis are taking place, instead of xanthopterin a dihydropterin and tetrahydropterin are present, both of which were found earlier in insects and amphibians. These pterins are located in bladders within the differentiating melanophores. The tetrahydropterin of animal source acts as a cofactor in enzymatic hydroxylation of phenylalanine to tyrosine (the 1st step in melanin synthesis) in the rat liver system, as was proved by Kaufman for synthetic dimethyltetrahydropterin. These results are discussed in connection with earlier results regarding melanophore development and differentiation. (Author)

7361. Labat, R., C. Peyraud, and A. Serfaty (Lab. Biol. Anim. Fac. Sci., Toulouse, France). 1962. THE ELECTROCARDIOGRAPHIC AND OPERCULAR REACTIONS OF MARINE TELEOSTS PROVOKED BY VISUAL STIMULATION OR PRESENTATION OF AN OBJECT. (RÉACTIONS ÉLECTROCARDIOGRAPHIQUES ET OPERCULAIRES PROVOQUEÉS PAR STIMULATION LUMINEUSE OU PAR EFFET D'APPROCHE CHEZ LES TÉLÉOSTÉENS MARINS.) (English summ.) Jour. Physiol. (Paris) 54(4): 591-598; Biological Abstracts, Vol. 45, No. 9, Abst. No. 37436. 1964.

In marine teleosts it has been found that a reflex inhibition of cardiorespiratory rhythm follows the shining of a light at eye level. There is a simultaneous slowing of the heart and a decrease in amplitude of opercular movement. The reflex is mediated by the vagus nerve, and particularly marked in pleuronectids (sole, flounder). It is less obvious in the nonhomochromic fish examined (drum fish, mullet). An identical reflex, but much more readily evoked and more long lasting, has been demonstrated only in homochromic fish by showing an object above the experimental tank. Slight movements of the object suffice to maintain the reflex inhibition. (Authors)

7362. Gulidov, M. V. (A. N. Severtsov Inst. Animal Morphol., Moscow, USSR). 1963. EMBRYONIC RESPIRATORY ORGANS OF VIVIPAROUS BONY FISHES. (ORGANY DYKHANIYA ZARODYSHEI ZHIVORODYASHCHIKH KOSTISTYKH RYB. (OBZOR LITERATURY).) Vopr. Ikhtiol. 3(2): 288-303. Illus.; Biological Abstracts, Vol. 45, No. 9, Abst. No. 37933. 1964.

Embryonic respiratory structures in 2 viviparous families, Anablepidae and Poeciliidae, having intrafollicular embryonic development, and in 4 viviparous families, Goodeidae, Brotulidae, Jenynsiidae, and Embiotocidae, having intraovarian embryonic development are reviewed. In Anablepidae the vascular projection-bearing surface of the yolk sac and walls of the alimentary canal serve as the primary respiratory organs (as well as nutritional organs). In Poeciliidae the highly vascularized, so-called "collar," formed by the joining of dorsal, yolk sac projections around the head, and the pericardial hood, as well as the vascularized opercle and entire body surface, serve as the primary embryonic respiratory structures (until normal gill functioning). In Heterandria formosa the highly vascularized urinary bladder is an additional respiratory structure. In most Goodeidae embryonic respiration is achieved by action of the pericardio-yolk sac complex and anal apendages, while in others, it is achieved by way of the highly vascularized unpaired fin folds and walls of the alimentary canal. In Brotulidae embryonic respiration is also effected by the anal appendages, while in Jenynsiidae, the pericardio-yolk sac complex, gills and alimentary canal all contribute in embryonic respiration. In Embiotocidae, the pericardio-yolk sac complex, vascularized surface of the unpaired fin folds, gills and alimentary canal (with the aid of the circulatory action of cilia and surplus spermatozoa, are the primary embryonic respiratory structures. Contrary to the situation in oviparous fishes, there are special embryonic respiratory organs in addition to the yolk sac in all of these families. Since the members of these families generally inhabit waters where the O_2 tension is relatively low, and since, then, the ovarian and follicular fluid O_2 tensions are concomitantly considerably lower, there is need for special embryonic respiratory devices to provide the developing embryo with sufficient oxygen. In addition to their respiratory capacities, almost all of the above structures serve in embryonic nutrition as well, and thus are dualistic in function. (L. T. P.)

7363. Clem, L. William, and M. Michael Sigel

(Sch. Med., Univ. Miami, Coral Gables, Florida). 1963. COMPARATIVE IMMUNOCHEMICAL AND IMMUNOLOGICAL REACTIONS IN MARINE FISHES WITH SOLUBLE, VIRAL, AND BACTERIAL ANTIGENS. In: Immunologic phenomena in cold-blooded vertebrates, 1963. Fed. Proc. 22(4 Pt. 1): 1138-1144. Illus.; Biological Abstracts, Vol. 45, No. 9, Abst. No. 38165. 1964.

7364. Papermaster, Ben W. (Dept. Genet., Stanford Univ., Palo Alto, California), Richard M. Condie, Joanne Finstad, and Robert A. Good. 1964. EVOLUTION OF THE IMMUNE RESPONSE. I. THE PHYLOGENETIC DEVELOPMENT OF ADAPTIVE IMMUNOLOGIC RESPONSIVENESS IN VERTEBRATES. Jour. Exptl. Med. 119(1): 105-130. Illus.; Biological Abstracts, Vol. 45, No. 9, Abst. No. 38207. 1964.

Rising levels of immune responsiveness and increasing complexity of serum proteins in the gamma area immunoelectrophoretically are observed going up the phylogenetic scale of the cyclostomes to the teleosts. Hagfish, the lowest vertebrate forms, lack all evidence of adaptive immunity and have no globulin of the gamma type. The lamprey has a feeble antibody response and a single faint gamma band. The bowfin (holostean) and the guitarfish and horned shark (both elasmobranches) have greater immunologic capability, particularly in the secondary response to certain antigens. The bowfin and the 2 teleost fishes studied form precipitating antibody, lacking in the cyclostomes and elasmobranchs. All of the latter have bands in the gamma region which resemble those of human gamma globulin. The capacity for antibody production is apparently paralleled by delayed hypersensitivity and homograft immunity in phylogeny, but these studies are incomplete. (Authors)

7365. Hildemann, W. H., and E. L. Cooper (Sch. Med., Univ. California, Los Angeles). 1963. IMMUNOGENESIS OF HOMOGRAFT REACTIONS IN FISHES AND AMPHIBIANS. In: Immunologic phenomena in cold-blooded vertebrates, 1963. Fed. Proc. 22(4 Pt. 1): 1145-1151. Illus.; Biological Abstracts, Vol. 45, No. 9, Abst. No. 38383. 1964.

7366. Holloway, Harry L., Jr. (Roanoke College, Roanoke, Virginia), and Burton J. Bogitsh. 1964. HELMINTHS OF WESTHAMPTON LAKE FISH. Virginia Jour. Sci. 15(1): 41-44; Biological Abstracts, Vol. 45, No. 9, Abst. No. 39578. 1964.

The hosts, examined during 1950-51, were recovered from the century old, artificial lake situated on the University of Richmond Campus in Henrico County, Virginia. The intestinal tracts of 87 fish representing 4 families, 8 species, and 2 hybrids, were individually examined microscopically and parasite recovery was facilitated by scraping, agitation, filtration, sedimentation, and centrifugation. The mean and range of infection with the following helminths are given for each host species: Alloglossidium corti and Lepidauchen sp. in the northern brown bullhead; Neoechinorhynchus cylindratus in the largemouth bass; Crepidostomum cornutum, N. cylindratus, Camallanus sp. and Capillaria sp. in the warmouth; metacercariae of Clinostomum marginatum, C. cornutum, Dorylaimus sp. (genus of free living nematodes) and fragments of a pseudophyllidean tapeworm in the pumpkinseed; C. cornutum, N. cylindratus, Camallanus sp., Capillaria sp. and Dorylaimus sp. in the common bluegill; N. cylindratus and Capillaria sp. in the black crappie; N. cylindratus in the yellow perch; and Camallanus sp. in one hybrid and N. cylindratus in another hybrid. No helminths were recovered from the 9 golden shiners examined. With the exception of N. cylindratus (Holloway, 1951, Va. J. Sc.) all helminths reported are new locality records. (Authors)

7367. Izyumova, N. A. 1958. OXYGEN REGIME OF THE WATER RESERVOIR AS A FACTOR DETERMINING THE BIOLOGY OF DACTYLOGYRUS SOLIDUS AND D. VASTATOR. (KISLORODNYI REZHIM VODOEMA KAK ODIN IZ FAKTOROV, OPREDELYAYUSHCHIKH BIOLOGIYU DACTYLOGYRUS SOLIDUS I DACTYLOGYRUS VASTATOR.) (English summ.) Parazitol. Sb. 18: 295-303; Referat. Zhur., Biol., 1960, No. 6693; (Translation) Biological Abstracts, Vol. 45, No. 9, Abst. No. 39579. 1964.

When the O_2 content of the water decreases, the parasites on the gills of fish relocated, and the number of eggs laid by the worms increases, which may have some importance when fish are transported and when ponds are emptied. The subsequent increase in the O_2 content of the water results in the relocation of the parasites to their usual sites. The O_2 regime had no special influence on the biology of D. vastator. This difference is connected with evolutionary features of both species of parasites. (Courtesy NSF (PL 83-480) 1963)

7368. Bullock, Graham L. (Bur. Sport Fish. and Wildl., Eastern Fish Disease Lab., Kearneysville, West Virginia). 1965. CHARACTERISTICS AND PATHOGENICITY OF A CAPSULATED PSEUDOMONAS ISOLATED FROM GOLDFISH. Applied Microbiology, Vol. 13, No. 1, pp. 89-92.

Characteristics of a capsulated bacterium isolated from an epizootic among goldfish (Carassius auratus) were determined as well as the ability of the bacterium to produce experimental infections. The bacterium was found to be a gram-negative rod which oxidized carbohydrates, produced green fluorescent pigment, and otherwise seemed to fit into the genus Pseudomonas, except that it was nonmotile and failed to oxidize gluconate. These last two characteristics are typical of pseudomonads. However, the bacterium was classified as a pseudomonad, best fitting the description of the nonmotile variety of Pseudomonas fluorescens. Goldfish and rainbow trout (Salmo gairdneri) were infected experimentally by injection, but not by being fed bacteria-laden food. Goldfish were infected by exposure to the bacterium, but only if two or three scales were removed prior to exposure. It is

suggested that the bacterium is an opportunistic pathogen. (Auth. Abst.)

7369. Gofman-Kadoshnikov, P. B. 1963. STAGES CHARACTERIZING THE FORMATION OF NEW DIPHYLLOBOTHRIASIS FOCI AND PROPHYLACTIC MEASURES BASED ON STAGES. (ETAPY STANOVLENIYA NOVYKH OCHAGOV DEFILLOBOTRIOZA I POETAPNAYA PROFILAKTIKA.) Med. Parazitol. i Parazitar. Bolezni 32(5): 589-600; (English summ.) Biological Abstracts, Vol. 45, No. 9, Abst. No. 39599. 1964.

The development of foci in water reservoirs includes 3 distinct stages; (a) potential (b) exogenous and (c) endogenous. A water basin may become a diphyllobothriasis focus only when an aggregate of ecological conditions has been established ensuring successive life-cycle of the parasite. These not only include the presence of specific Copepods and fish--specific hosts of Diphyllobothrium latum, but also a minimum number of these with favorable biotopes. So long as the water basin is not infected with Diphyllobothrium larvae it appears as a potential diphyllobothriasis focus. The potential focus turns into an active one only after a sufficiently intensive invasion has been imported from outside, when it enters the stage of an exogenous focus. As the infection of fish within an exogenous focus grows, there is a parallel increase of the infection rate among the local population. The focus enters the endogenous stage of its development. The discontinued growth of larval diphyllobothriasis in fish and increased prevalence of the disease among the population serve an indication of the stabilization of the focus, which then assumes epidemiological characteristics of long-standing foci. Apart from the foci of the lake and river types established earlier, the author notes additionally those in the river mouths and in the sweet water areas of the sea. The study of conditions attending formation of foci permitted definition of concretely preventive measures, properly timing them to each individual stage in the focal development. (From Auth. Summ.)

7370. Gofman-Kadoshnikov, P. B., V. I. Khodakova, T. P. Chizhova, and E. G. Kravtsov (I. M. Sechenov 1st Moscow Med. Inst., Moscow, USSR). 1963. THE ROLE OF THE STICKLEBACK (GASTEROSTEUS ACULEATUS) IN THE SPREAD OF DIPHYLLOBOTHRIASIS. (ROL' DEVYATIIGLOI KOLYUSHKI V RASPROSTRANENII DIFILLOBOTRIOZA.) Med. Parazitol. i Parazitar. Bolezni 32(4): 460-465; (English summ.) Biological Abstracts, Vol. 45, No. 9, Abst. No. 39600. 1964.

The high infection rate of the stickleback with Diphyllobothrium plerocercoids strongly suggests its possible participation in the maintenance of diphyllobothriasis foci. The authors' experiments involving infection of the stickleback with the larvae proved that this species is to be added to the number of D. latum hosts. The first infective larvae are 16-day-old procercoids. Penetration into the fish tissues occurs in the stomach. Upon their stay 16-18 days in the gastric wall, the larvae become encapsulated and then die, while those embedded in the body cavity show an intensive growth and acquire infective properties. The significance of the stickleback in the epidemiology of diphyllobothriasis is in its being instrumental in the spread of the tapeworm larvae among predatory fishes. (From Auth. Summ.)

7371. Lom, Jiri (Inst. Parasitol., Czechoslovak Acad. Sci., Prague, Czechoslovakia). 1963. THE CILIATES OF THE FAMILY URCEOLARIIDAE INHABITING GILLS OF FISHES (THE TRICHODINELLA-GROUP). Vest. Ceskoslov. Spolecnosti Zool. 27 (1): 7-19. Illus. (Czech summ.); Biological Abstracts, Vol. 45, No. 9, Abst. No. 39668. 1964.

A group of genera of the family Urceolariidae parasitizes gills of fishes. They differ from other representatives of the family--besides a strict localization on the gills--by shortened adoral spiral (1/2 to 3/4 of a turn), by different shape of the elements of the adhesive disc and by generally smaller dimensions. A standard impregnation technique for their study is given. The paper deals in detail with the morphology and taxonomic position of species living in Czechoslovakia. The genus Trichodinella Sramek-Husek, 1953, is divided into 2 subgenera, differing in the formation of the skeletal ring of the adhesive disc: subg. Trichodinella s. str. with the species T. epizootica living on the gills of Perca fluviatilis, Acerina cernua, Esox lucius, Lota lota, Lucioperca lucioperca, Salmo trutta m. fario, Barbus barbus and Rhodeus sericeus, and subg. Foliella Lom, 1959, with the species T. (Foliella) subtilis, invading the gills of Cyprinus carpio, Carassius carassius, Tinca tinca, Rhodeus sericeus, and Blicca bjorkna. The genus Tripartiella Lom, 1959 is, according to the morphology of the adhesive disc, divided into subgenera Tripartiella s. str. and PARATRICHODINA. The first is represented by the species T. copiosa from the gills of Rutilus rutilus, Alburnus alburnus, Leuciscus leuciscus, Rhodeus sericeus, Blicca bjorkna, Leuciscus cephalus, Leucaspis delineatus and Cobitis taenia, and by T. lata from the gills of Phoxinus phoxinus. The subgenus is represented by the species T. (Paratrichodina) incissa, invading the gills of Nemachilus barbatulus, Phoxinus phoxinus, Rutilus rutilus, Gobio gobio and Scardinius erythrophtalmus. Two species are described from the gills of the Black Sea fishes, T. (Paratrichodina) obliqua from Crenilabrus griseus and Scomber scomber, and T. (Paratrichodina) globonuclea from Ophidion barbatum and Gaidropsis mediterranaeu. The position of these genera within the family Urceolariidae is discussed, as well as the division into subgenera, and the evaluation of individual morphological characters. (Auth.)

7372. Ginsburg, Anna S. (Inst. Animal Morphol., Acad. Sci., Moscow, USSR). 1963. SPERM-EGG ASSOCIATION AND ITS RELATIONSHIP TO THE ACTIVATION OF THE EGG IN SALMONID FISHES. Jour. Embryol. and Exptl. Morphol. 11(1): 13-33; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40470. 1964.

In the lake trout Salmo trutta L. morpha lacustris Linne and the salmon S. salar L. morpha sebago Girard, in contrast with other animals possessing spermatozoa of the flagellate type, the union of gametes can be achieved without activation of the egg. It occurs when insemination is performed either in coelomic fluid or in Ringer's solution (in these media spermatozoa are activated and retain their motility and fertilizing capacity much longer than in water); cytological investigation shows that a spermatozoon reaches the cortical egg layer and the front part of its head is embedded in the cytoplasm. In spite of this the eggs in these media remain unchanged. Their development with involvement of the spermatozoon can be initiated at any moment (of a rather durable period, up to several days) by immersion into water. To attain such an effect a brief exposure to water is necessary (this varies from 10 to 70 seconds for different eggs). Normal development of the egg may be achieved upon its activation not only after but also shortly before insemination. The latent period of cortical reaction on activation of trout eggs by water in the majority of eggs takes 40-50 seconds at 3.0° C and 30-40 seconds at 8.9° C. The considerable autonomy of the phenomena of the union of gametes and egg activation (manifested in the possibility of their separation in time and combination in any sequence) seems to be related to a particular structural feature of the spermatozoon, the absence of an acrosome. The evidence of the latter is given by the electron microscopic study of trout spermatozoa: being placed into egg-water and other media containing products of egg secretion, they do not show any changes resembling the extrusion of an acrosome filament. (Auth.)

7373. An-chi, Wong, and Wang Chen-yin (Inst. Genetics, Acad. Sinica, Peking, China). 1963. GENETIC EFFECTS ON GOLDFISH, CARASSIUS AURATUS, INDUCED BY ULTRASONIC WAVE. Acta Biol. Exptl. Sinica 8(2): 131-138. Illus.; (In Chinese with English summ.) Biological Abstracts, Vol. 45, No. 10, Abst. No. 40528. 1964.

Mature goldfish of both sexes were treated with 3 intensities and frequencies of ultrasonic waves as follows: 22KC, 0.5—1.0 W/cm.^{2}; 20 KC, 0.8/Wcm.^{2}; and 800 KC, 0.6—2.0 W/cm.^{2}. Dominant lethal effects and a dominant visible mutation were observed in the offspring. Monstrosities and high mortality rate were produced in the embryonic stages of the F_1. Experimental data indicates that there might be a threshold effect for the intensity and duration of the ultrasonic treatment in producing dominant lethals in goldfish. Goldfish individuals with deficient operculum were found among the offspring of the treated goldfish from F_1—F_3 generations, with a rate about 4—30% in different groups of each generation. Such deficiency was rare among normal goldfish and none was found in the control groups. Evidently it is a mutational character induced by ultrasonic treatment. It first appeared in the F_1 generation; therefore, it might be a dominant visible mutation. The degree of deficiency of the operculum is irregular and the rate of appearance in each generation is also irregular. (Authors)

7374. Anderson, J. B. (U. S. Publ. Hlth. Serv., Dallas, Texas), E. C. Tsivoglou, and S. D. Shearer. 1963. EFFECTS OF URANIUM MILL WASTES ON BIOLOGICAL FAUNA OF THE ANIMAS RIVER (COLORADO-NEW MEXICO). In: Radioecology. Proceedings of the First National Symposium on Radioecology. Reinhold Publishing Corporation: New York 22. pp. 373-383. Illus. Map; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40780. 1964.

Bottom fauna in the Animas River from the mill to the New Mexico state line were much less abundant than above the mill and in unpolluted tributary streams. Few or none of the insects important as food for fishes were found in approximately 30 to 40 miles of polluted river below the mill. Fly larvae were the most resistant to pollution and were found at nearly all stations. The reduction of food supply and the direct toxic effects of the mill wastes reduced numbers of fish below the mill. This was verified with fish collections obtained by rotenone application. Some limited improvement was noted in late 1959 a few months after the institution of pollution abatement measures, but insufficient time had elapsed for substantial stream recovery. There was a prolific growth of algae extending 24 miles below the mill. Algae were less abundant 28 miles below the mill and appeared in normal quantity 36 miles below the mill. As the number of insects increased, the amount of algae decreased. Toxicity tests using rainbow trout with various mill wastes were useful in determining the most harmful wastes. Median tolerance limit values ranged from 0.09% to 0.22% for organic raffinate wastes. Other wastes were less toxic. Based upon the volumes of wastes discharged to the river and their toxicity, it was estimated that about 600 cubic feet/second were needed in 1958 to dilute wastes in the river to protect fish life. By the fall of 1959 a program of waste treatment and storage of the most toxic waste in ponds had been effected. It was estimated from the toxicity studies that river dilution requirements had been reduced to 144 cubic feet/second. The data regarding the Ra-226 content of attached filamentous algae, aquatic insects, and fish from the Animas River and other streams yield a good deal of information regarding the fate of this material in the water environment and its uptake by the aquatic biota. The data have demonstrated similar Ra-226 concentrations at both polluted and clean locations for the algae and aquatic insects, whence it has been concluded that the former might better serve as an indicator of Ra-226 pollution because of the relative ease of collection. A relation between the Ra-226 content of the algae and the associated dissolved Ra-226 in water has been shown, and, while not precise, appears to be adequate for estimating purposes. It, thus, appears that such algae samples are useful as indicators of

Ra-226 pollution. Ra-226 concentration factors for algae, insects, and skeletons and flesh of large suckers have been derived and appear to be consistent among themselves and among the types of biota. Thus, it has been indicated that a concentration factor for attached filamentous algae is in the range of 500 to 1000, and that the corresponding factor for aquatic insects is no different. Ra-226 concentration factors for sucker skeletons appear to be about 100, while for sucker flesh a concentration factor of only three was observed, demonstrating the bone-seeking qualities of Ra-226. Although only a small number of suckers were involved in these latter determinations, the results appear to be quite consistent. (Authors)

7375. Bachmann, Roger W. (Woods Hole Oceanog. Inst., Woods Hole, Massachusetts). 1963. ZINC-65 IN STUDIES OF THE FRESH-WATER ZINC CYCLE. In: Radioecology. Proceedings of the First National Symposium on Radioecology. Reinhold Publishing Corporation: New York 22. pp. 485-496. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40781. 1964.

It was the purpose of this study to determine quantitatively some of the factors which affect the distribution of Zn between the water and various solid materials in lakes and to apply this information toward the formation of a hypothetical outline of the fresh-water Zn cycle. Zn-65 was used as a tracer to measure the uptake of Zn by suspensions of Golenkinia paucispina, organic detritus, lake sediments, and natural lake seston. It was also used to follow uptake by Daphnia pulex and Daphnia magna in relation to the presence of suspended materials. Artificial sediment-water systems were used to measure Zn uptake by lake sediments and to determine the influence of nymphs of the mayfly Ephemera simulans on its penetration into such sediments. For all of the suspended materials tested the amount of Zn taken up at equilibrium could be related to concentration in solution by the Freundlich adsorption isotherm: $x = mkc^n$ where x is the amount taken up, c is the concentration in solution, m is the mass of adsorbent, and k and n are constants. It was also found that Zn uptake was decreased as the concentrations of other cations in solution were increased. The order of effectiveness of the respective ions in reducing Zn uptake by Golenkinia cells was $H^+ > Ca^{++} > Mg^{++} > Na^+ > K^+$. It was concluded that these materials were accumulating Zn by means of an ion exchange type reaction. Experiments with Daphnia pulex indicated that this animal takes up Zn primarily by grazing on particles to which Zn is adsorbed rather than directly from solution, and that a large percentage of this will be lost when the animal is placed in a fresh medium. More detailed investigations with Daphnia magna showed that a population of 100 animals per liter accumulated less than 1% of the total Zn available. Oxidized sediments were found to remove as much as 96% of the Zn added to the water above them; whereas, reduced sediments would take up only about one-fifth as much. About 90% of the Zn taken up by such sediments did not penetrate deeper than 6 mm from the sediment surface. When nymphs of the mayfly Ephemera simulans were present, the Zn was mixed into the sediments and approached a uniform distribution. These nymphs did not accumulate a significant fraction of the Zn available. By use of the Freundlich equation, theoretical curves were derived to predict the Zn distribution between liquid and solid phases in lakes as a function of the total content and the mass of suspended material present. A theoretical outline of the fresh-water Zn cycle was presented which was characterized by exchanges between dissolved Zn and various organic and inorganic suspended materials as well as rooted aquatic plants and bottom sediments. The transfer of Zn to the sediments by the sedimentation of adsorbents is considered to be an important mechanism for the removal of the ion from lake waters. A net accumulation of Zn in the sediments should be the result. The formation of organic chelates and inorganic complexes are suggested as possible factors which may alter the scheme proposed. (Auth.)

7376. Cook, Sherburne F., Jr., and Jerrold D. Conners (Lake County Mosquito Abatement Dist., Lakeport, California). 1963. THE SHORT-TERM SIDE EFFECTS OF THE INSECTICIDAL TREATMENT OF CLEAR LAKE, LAKE COUNTY, CALIFORNIA, IN 1962. Ann. Entomol. Soc. Amer. 56 (6): 819-824. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40784. 1964.

Clear Lake, Lake County, California, was treated to control the Clear Lake gnat, Chaoborus astictopus Dyar and Shannon, during the summer of 1962 with 3 ppb methyl parathion. Concurrent with this control project, information was gathered on representatives of the major trophic groups. This data was compared with similar data gathered at the same time the previous non-treatment year to determine if any immediate side effects of the insecticide were manifest. Although it was impossible to study all the organisms involved with the treatment, results indicated a possible depressing effect only upon the zooplankton levels. No direct effects on the bottom fauna, other than C. astictopus, or on the fishery were observed. (Authors)

7377. Hasler, Arthur D., and Gene E. Likens (Hydrobiol. Lab., Univ. Wisconsin, Madison). 1963. BIOLOGICAL AND PHYSICAL TRANSPORT OF RADIONUCLIDES IN STRATIFIED LAKES. In: Radioecology. Proceedings of the First National Symposium on Radioecology. Reinhold Publishing Corporation: New York 22. pp. 463-470. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40793. 1964.

7378. Lenhard, G., and A. du Plooy (National Inst. Water Res., Pretoria, Union S. Africa). 1963. STUDIES ON THE REMOVAL OF SYNTHETIC DETERGENTS FROM THE WATER PHASE OF BOTTOM DEPOSITS BY PHYSICAL ADSORPTION AND BIOCHEMICAL DEGRADATION. Hydrobiologia 22(3/4): 317-323; (German summ.) Biological

Abstracts, Vol. 45, No. 10, Abst. No. 40796. 1964.

Balance studies on bottom deposits to which standard synthetic detergent (manoxol) was added and which were incubated for three days revealed that biochemical degradation of the detergent takes place to a considerable extent. Maximum degradation, as assessed by difference between added and recovered manoxol after incubation, takes place in samples of pronounced biochemical activity (dehydrogenase activity), while in samples which exhibit high adsorption characteristics the degradation of manoxol is impaired. In active sediments an increase in the residual adsorbed manoxol was observed in sediments which showed a relatively high absorption capacity for manoxol. Negligible degradation was found after incubation in sediments lacking biochemical activity. (Auth. Summ.)

7379. Minckley, W. L., J. E. Craddock, and L. A. Krumholz (Dept. Biol., Univ. Louisville, Louisville, Kentucky). 1963. NATURAL RADIOACTIVITY IN THE FOOD WEB OF THE BANDED SCULPIN COTTUS CAROLINAE (GILL). In: Radioecology. Proceedings of the First National Symposium on Radioecology. Reinhold Publishing Corporation: New York 22. pp. 229-236. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40798. 1964.

7380. Nauwerck, Arnold. 1963. THE RELATIONS BETWEEN ZOOPLANKTON AND PHYTOPLANKTON IN LAKE ERKEN (SWEDEN). (DIE BEZIEHUNGEN ZWISCHEN ZOOPLANKTON UND PHYTOPLANKTON IM SEE ERKEN.) Symbolae Bot. Upsaliensis 17(5): 1-163; (English summ.) Biological Abstracts, Vol. 45, No. 10, Abst. No. 40801. 1964.

The author attempts to determine quantitatively the dependence of herbivorous zooplankton on the phytoplankton in eutrophic Lake Erken, in which chemical conditions are very stable. By determining the specific volume of each species, the total volume of plankton can be calculated; the dry weight of the most important species of zooplankton was also determined. Growth of phytoplankton was determined by a C^{14} method for measuring assimilation; by recalculation of assimilated carbon to a fresh weight basis, production of organic material was assessed. Growth of zooplankton was determined by investigating the rate of growth and calculating the dynamics of the population according to Elster's method. The interrelation between phyto- and zooplankton was determined by measuring the rates of infiltration by the animals in natural plankton communities. Among algae, Peridineae, diatoms and blue-green algae dominate; small chrysomonads are also qualitatively and quantitatively important as food for animals; next in importance are cryptomanads, small green algae and diatoms. Among zooplankton, Eudiaptomus graciloides dominates; Daphnia longispina, Bosmina corregoni, Ceriodaphnia quandrangula, Diaphanasoma brachyurum, and Mesocyclops leuckarti are important. Rotifers are numerically well represented but unimportant in total volume. By volume, the proportion of plants to animals is an average of 0.18; on no occasion was total volume of algae larger than total volume of zooplankton. The measured primary production was 160 mg fresh weight per cm^2 of water surface, of which 98 mg was nannoplankton (as minimum values). Production of herbivores was 40 mg/year/cm^2, of which 60% was Eudiaptomus. The filtration rates vary between 0.3 and 2.8 mg/animal/day for Eudiaptomus; between 0.2 and 4.5 ml for Daphnia, using the C^{14} technique. The animals could not take up sufficient algae to account for their own substance production. The phytoplankton is, thus, of secondary importance as a direct source of food for the zooplankton of this lake; the most important is presumed to be bacteria. The apparent contradiction in the trophic pyramid of the lake is explained: the greater part of the herbivore production is not utilized by carnivores, but via bacteria by the herbivores again. Levels of the trophic pyramid are often short-circuited, a comparatively small addition from a lower level being sufficient to maintain the higher level. (W. W. B.)

7381. Neess, John C. (Dept. Zool., University of Wisconsin, Madison), Richard C. Dugdale, John J. Goering, and Vera A. Dugdale. 1963. USE OF NITROGEN-15 FOR MEASUREMENT OF RATES IN THE NITROGEN CYCLE. In: Radioecology. Proceedings of the First National Symposium on Radioecology. Reinhold Publishing Corporation: New York 22. pp. 481-484. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40802. 1964.

If the capacity for fixing nitrogen is as widely distributed among natural waters as now seems to be the case, then it would appear that the N supplies of such waters do not depend entirely upon delivery of fixed N in influents, but may, perhaps in very large part, originate in situ. Because the fixed N delivered to a lake by N-fixing blue-green algae is potentially available to all components of the lake's biota, external sources of fixed N need never constitute a condition in control of the lake's general productivity. Although good information on the distribution of the ability to fix N among the members of a typical lake's biota, or even among its plankton algae, or even, for that matter, among its blue-green algae belonging to the family Nostocaceae, is still incomplete, it seems safe enough to say that the ability is not universally a property of the species of algae making up the whole phytoplankton. The fact that some phytoplankters can fix N and others cannot may eventually go a long way to explain the striking seasonal succession of species of plankton algae so often observed in eutrophic lakes. To find an explanation of this phenomenon has been a distressing problem, much studied but not yet satisfactorily solved. The familiar mid-summer or late-summer dominance of the blue-green algae is very suggestive here.

7382. Verduin, Jacob (Bowling Green State Univ., Bowling Green, Ohio). 1963. SIMPLE MEASUREMENT OF RESPIRATION AND PHOTOSYNTHESIS IN AQUATIC ORGANISMS. Turtox News 41(9): 234-237; Biological Abstracts, Vol. 45, No. 10, Abst.

No. 40809. 1964.

Directions are given for computing rates of respiration and photosynthesis of common freshwater organisms and for computing CO_2 changes in natural bodies of water during the course of a day. (R. W. D.)

7383. Kanayama, Richard K. (Bur. Comm. Fish., Marquette, Michigan). 1963. THE USE OF ALKALINITY AND CONDUCTIVITY MEASUREMENTS TO ESTIMATE CONCENTRATIONS OF 3-TRIFLUORMETHYL-4-NITROPHENOL REQUIRED FOR TREATING LAMPREY STREAMS. Great Lakes Fish. Comm. Tech. Rept. 7. 1-10. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40813. 1964.

A method has been devised to estimate the minimum concentration of TFM that will kill sea lampreys and the maximum that will not kill fish. It is based on the relation of these concentrations to the alkalinity and conductivity of various waters. Pretreatment bioassays will continue to be required for precise determination of treatment concentrations, but the estimates made possible by the method will permit a great reduction in the number of bioassays on a single stream. (Auth.)

7384. Van Cleve, Richard (Col. Fish., Univ. of Washington, Seattle), and Ralph W. Johnson. 1963. MANAGEMENT OF THE HIGH SEAS FISHERIES OF THE NORTHEASTERN PACIFIC. Univ. Washington Publ. Fish. 2(2): 1-63; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40819. 1964.

A preliminary survey of the pressing fishery problems must recognize that claims to territorial waters by different nations vary in width from 3 to 12 miles, but exclusive claims to fisheries have been extended as far as 200 miles, from shore by a few states. Consideration of the consequences of applying different methods of protecting the fisheries in the northeastern Pacific leads to the conclusion that fishery problems there can be solved best by treaties, but these, to be effective, must incorporate agreement on basic objectives. The validity of the abstention principle as defined in the North Pacific Treaty and the need for such protection of fisheries which are controlled by scientifically based management programs are shown by the successful management of the northeastern Pacific halibut and salmon fisheries of this area. This is further supported by a consideration of both the biological and economic bases of fisheries management. Maximum sustained yield as defined by the North Pacific Treaty is not considered a sound basis for abstention or regulation, since it has been considered to be an absolute and single valued population parameter that must be defined and supported by biological data. The variability of this quantity makes the optimum economic yield a more usable objective. Consideration of the qualifications for abstention listed in the North Pacific Treaty and the data available on the Bristol Bay halibut stock indicates that the latter fulfills the requirements for abstention. Removal of this stock from the protection by abstention required special interpretation of the present treaty. Evaluation of the legal, biological, and economic background of high seas fisheries leads to the conclusion that future progress in rational development of the northeastern Pacific fisheries will be aided by continuation of the principle of abstention as outlined in the present North Pacific fisheries treaty. Successful operation of the commission, however, seems to require alteration of the treaty to provide the commission with its own research staff and to charge it with the responsibility of handling the problems posed by the treaty and by the fisheries. (64 references and International Convention for the High Seas Fisheries of the North Pacific Ocean.) (Authors)

7385. Szabolics, M., A. Kover, and K. Benko (Ctr. Lab., Inst. Physiol., Med. Univ., Debrecen, Hungary). 1963. STUDIES OF THE PHYSICOCHEMICAL AND ENZYMOCHEMICAL PROPERTIES OF STRUCTURAL PROTEINS EXTRACTED FROM FISH MUSCLE. II. THE EFFECT OF CHANGES IN THE CONDITIONS OF EXTRACTION ON THE HOMOGENEITY AND ENZYMATIC ACTIVITY OF FISH MYOSIN PREPARATIONS. Acta Physiol. Acad. Sci. Hung. 23(3): 239-245. Illus.; (Russian and English summ.) Biological Abstracts, Vol. 45, No. 10, Abst. No. 40926. 1964.

The myosin preparations extracted from the skeletal muscle of Amiurus nebulosus have been studied. It has been found that fish myosin represents a labile structure, insofar as, unlike rabbit myosin, even the changes in the conditions of extraction and fractionation lead to the appearance of components having lower sedimentation coefficients. It has also been shown that not the whole myosin molecule, but only a small fraction of it, is responsible for the cholinesterase activity of fish myosin. The use of Mg^{++} at fractionation allows isolation of the fraction responsible for cholinesterase activity and its identification with other structural muscle proteins. (Authors)

7386. Moule, Margaret L. (Dept. Biol., McMaster Univ., Hamilton, Ontario, Canada), and Paul Foley Nace. 1963. REDUCING SUBSTANCES IN THE BLOOD OF NORMAL AND ALLOXAN-TREATED FISH. Canadian Jour. Biochem. and Physiol. 41 (2): 2397-2407. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 40943. 1964.

Blood sugar changes in fish, after the intravenous injection of alloxan, were determined by a modified Folin method and by an enzymatic method using glucose oxidase. The rest reduction was calculated as the difference between the two methods. The blood rest reduction levels were normally 15 mg% in toadfish and 11 mg% in bullheads (glucose 19 and 22 mg% respectively). One hour after alloxan administration, the rest reduction had increased on the average several times while the glucose level was only slightly above normal. From a maximum at 1 hour the rest reduction level dropped while the glucose level began to rise. Considerable variation in the response to alloxan occurred. The reducing substances in the blood

were studied by paper chromatography. In normal blood, glucose and another compound (R_f value approximately one-half that of glucose) were detected by alkaline silver nitrate. No increase in reducing material in alloxan-treated samples could be shown on the chromatograms by the methods used. (Authors)

7387. Shanta, N., and I. Motelike. 1962. A STUDY OF THE ASCORBIC ACID CONTENT OF THE CARP. (ISSLEDOVANIE SODERZHANIYA VITAMINA C U KARPA.) Rev. Biol. (Romania) 7(1): 137-147. Illus. Biological Abstracts, Vol. 45, No. 10, Abst. No. 41276. 1964.

Distribution of ascorbic acid in the carp body is like that of other animals, except that in the carp there is considerable seasonal variation attributed to metabolic processes in which the acid takes part. The total content in the carp body depends on its physiological state. There is a winter level representing the low threshold, and a summer level (high threshold). The administration of supplementary ascorbic acid did not change these thresholds. Bibliography with 18 references. (V. E.)

7388. Conte, Frank P. (Oregon State University, Corvallis). 1963. MEASUREMENT OF BLOOD VOLUME IN THE FISH (SALMO GAIRDNERI GAIRDNERI). In: 47th Annual meeting of the Federation of American Societies for Experimental Biology, 1963. Fed. Proc. 22(2 Pt. 1): 682; Biological Abstracts, Vol. 45, No. 10, Abst. No. 41484. 1964.

Abstract only available.

7389. Ranelli, George M., Jr., and Ross F. Nigrelli (Harvard Med. Sch., Boston, Mass.). 1963. RENAL EXCRETION OF TETRACYCLINE IN THE AGLOMERULAR TOADFISH, OPSANUS TAU. Proc. Exptl. Biol. and Med. 114(3): 582-584. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 41525. 1964.

Tritiated tetracycline, after injection into the aglomerular toadfish, appears to be excreted by a diffusion process. The aglomerular renal tubule is permeable to a highly complex molecule such as tetracycline. (Authors)

7390. Ahsan, S. Nazar, and William S. Hoar (Dept. Zool., Univ. British Columbia, Vancouver, B. C., Canada). 1963. SOME EFFECTS OF GONADOTROPIC HORMONES ON THE THREESPINE STICKLEBACK, GASTEROSTEUS ACULEATUS. Canadian Jour. Zool. 41(6): 1045-1053. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 41608. 1964.

Sticklebacks collected during the autumn and maintained under 8-hour daily photoperiods did not mature sexually; their gonads remained in the condition characteristic of late summer and autumn fish in nature and probably did not change after the fish were placed under controlled photoperiods. No stimulation of the gametogenetic and related tissues occurred when these fish were treated with purified mammalian FSH (Armour) but LH (Armour) produced a maturation of all gonads to stages characteristic of late winter and spring fish; with LH, 80% of the individuals attained the stages of sexually mature fish in nature. Chorionic gonadotropins (Organon) also had a stimulatory effect but were considerably less active than the LH; PMS was more effective than HCG. TSH (Parke Davis or Organon) had a marked gonadotropic action as well as the expected thyrotropic effect and stimulated the reproductive organs to about the same degree as the chorionic gonadotropins. Crude extracts of alcohol-preserved salmon pituitaries were only mildly active but stimulated all gonads to stages beyond those normally found in the late summer and autumn. (Authors)

7391. Klicka, John Kenneth. 1963. SOME PHYSIOLOGICAL EFFECTS OF ACTH, TSH, AND THYROID HORMONES IN GOLDFISH. Dissert. Absts. 23(11): 4402; Biological Abstracts, Vol. 45, No. 10, Abst. No. 41668. 1964.

7392. Wiggs, Alfred J. (Dept. Zool. Univ. Brit. Columbia, Vancouver, B. C., Canada). 1963. NOTES ON THE USE OF THE CONVERSION RATIO AS AN INDEX OF THYROID ACTIVITY (IN FISH). Canadian Jour. Zool. 41(6): 1176-1177. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 41674. 1964.

7393. Amberson, William R., and Adelia C. Bauer (Mar. Biol. Lab., Woods Hole, Mass.). 1963. PROTEINS OF TOADFISH SWIM BLADDER MUSCLE. In: 47th Annual meeting of the Federation of American Societies for Experimental Biology, 1963. Fed. Proc. 22(2 Pt. 1): 177; (Abstract only.) Biological Abstracts, Vol. 45, No. 10, Abst. No. 41678. 1964.

Proteins and protein complexes in press juice obtained by centrifugation of whole muscles, and extracts of the pressed muscle, containing myogen, myosin, and delta protein, but no actin have been examined by electrophoresis. The activity of lactic dehydrogenase in whole muscle homogenates is about 30% higher in skeletal muscle than in swim bladder muscle. Other differences between the two muscles are relatively small. The values suggest that structural specialization is much more important than protein composition in determining the short latency and rapid contraction of swim bladder muscle. (From Auth. Abst.)

7394. Waring, H. 1963. COLOR CHANGE MECHANISMS OF COLD-BLOODED VERTEBRATES. vii+ 266 pp. Illus. Academic Press, Inc.: New York 3. Pr. $9.50; Biological Abstracts, Vol. 45, No. 10, Abst. No. 41732. 1964.

This monograph attempts to present a connected account of color change mechanisms in cold-blooded vertebrates. Chapter 2 considers the kinds of color cells, the classes of response and their measurement, and the terminology of hormones involved in color change. Five sections of chapter 3 deal in turn with each vertebrate class: amphibians, elasmobranchs, teleosts, cyclostomes, reptiles; each of these sections opens with an account

of one or more examples that are best documented, and then, when feasible, attempts to draw generalizations from data concerning animals about which there is less complete information. Chapters 4 to 6 describe the biological assay, chemistry, and pharmacology of pituitary hormones involved in color response. Chapter 7 considers morphological color change in response to background, Chapter 8 the possible survival value of color change, and Chapter 9 the possible actions of melamin-dispersing hormone on functions other than color change. The introduction states that the volume is addressed to senior undergraduate students in zoology, physiology, pharmacology and biochemistry; in the United States it would probably be most useful to graduate students in these fields. (J. O.)

7395. de la Motte, Ingrid (Zool. Inst. Univ., Munich, W. Germany). 1963. INVESTIGATIONS OF THE COMPARATIVE PHYSIOLOGY OF PHOTOSENSITIVITY OF BLINDED FISH. (UNTERSUCHUNGEN ZUR VERGLEICHENDEN PHYSIOLOGIE DER LICHTEMPFINDLICHKEIT GEBLENDETER FISCHE.) Naturwissenschafter 50(9): 363. Illus.; Biological Abstracts, Vol. 45, No. 10, Abst. No. 41746. 1964.

Photosensitivity of blinded minnows was measured; the wave-length at which the greatest sensitivity occurs is about 525 mμ. Many fresh-water fish possess photosensitive areas in the epiphysis-mesencephalon area. (J. G.)

7396. James, Suzanne Murray. 1963. STUDIES OF ERYTHROCYTE ANTIGENS IN TWO TROUT SPECIES OF THE GENUS SALVELINUS. Dissert. Absts. 24(3): 935-936; Biological Abstracts, Vol. 45, No. 10, Abst. No. 42744. 1964.

7397. Hĺond, Stefan. 1963. OCCURRENCE OF COSTIA NECATRIX HENNEGUY ON THE ROE OF THE CARP. (WYSTĄPIENIE COSTIA NECATRIX HENNEGUY NA IKRZE KARPIA.) Wiadomosci Parazytol. 9(3): 249-251; (English summ.) Biological Abstracts, Vol. 45, No. 10, Abst. No. 44318. 1964.

The occurrence of Costia necatrix in a spawning carp is reported. The infection ran a very rapid course, attacking in several days the whole roe. There was a high mortality of the young larvae of the carp when directly attacked by the flagellate. (From Auth. Summ.)

7398. Thorsteinson, Fredrik V., and Theodore R. Merrell, Jr. (Bur. Comm. Fish. Biol. Lab., Auke Bay, Alaska). 1964. SALMON TAGGING EXPERIMENTS ALONG THE SOUTH SHORE OF UNIMAK ISLAND AND THE SOUTHWESTERN SHORE OF THE ALASKA PENINSULA. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 486, 15 pp.

Sockeye, chum, and pink salmon were captured by purse seine and tagged from mid-June to mid-July 1961 south of Unimak Island and off the southwestern shore of the Alaska Peninsula. A westerly migration followed by a northeasterly migration was demonstrated. Tagged sockeye salmon were recovered mainly in the fisheries of the Kvichak, Naknek, and Egegik Rivers of Bristol Bay; tagged chum salmon were caught along the Bering Sea coast from Bristol Bay to the Yukon River; and most tagged pink salmon were recovered relatively close to the tagging area. (Authors)

7399. Sharpe, F. Phillip (Br. of Fishery Mgmt. Services, Ft. Collins, Colorado). 1964. AN ELECTROFISHING BOAT WITH A VARIABLE VOLTAGE PULSATOR FOR LAKE AND RESERVOIR STUDIES. U. S. Fish and Wildlife Service, Bur. Sport Fish. and Wildl., Bureau Circular 195, 6 pp.

The primary objective of these electrofishing investigations was to develop equipment for fish collection in lakes. The items described--a variable-voltage pulsating unit, underwater light, modified positive and negative electrodes, and other equipment--when used with standard electrofishing techniques have enabled the attainment of the primary objective within certain limits. The visibility provided by the underwater light, in conjunction with the electrode switches, permits the operating crew to select or reject the fish observed. The application of the lake electrofishing gear is limited by wind conditions and the turbidity and depth of the water. It proved to be a useful tool in making population estimates, observing reproduction, making limited observations of behavior, collecting spawn, removing rough fish, and capturing fish species of both large and small specimens, not readily taken with nets. This type of shocker appears to be an excellent tool for the collection of most lake-dwelling fishes. Mortality of fish is negligible. Cost of the unit including boat, motor, trailer, generator, and variable-voltage pulsator is about $1,500. The unit can be operated by individuals with no special training other than instruction in safety precaution. (Auth. Abst.)

7400. Post, George (Utah Dept. of Fish & Game, Logan). 1964. A REVIEW OF ADVANCES IN THE STUDY OF DISEASES OF FISH: 1954-64. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 3-12.

Several advances have been made in the study of diseases of fish in the last 10 years. Systematic diseases have been studied. New methods for using old therapeutic agents have been found, and a few therapeutic drugs not previously used to treat fish diseases have been evaluated. External parasitic and bacterial diseases have been somewhat neglected. There is a need for a disinfectant which has greater bactericidal activity and yet is less toxic to fish. A more economical, more effective compound for removing external protozoan parasites has not been found. Histopathology, cell and tissue culture, and immunological procedures have received more attention. The development of disease-resistant strains of fish has continued. Isolation, quarantine, and disinfection of the habitat,

as well as procedures for diagnosing fish diseases, have received attention. Several schematic procedures have appeared in the literature. Leaflets pertaining to various diseases, with special emphasis on causative organisms, have been brought up to date. (Auth.)

7401. Needham, Robert G. (Missouri Conservation Comm., Columbia). 1965. SPAWNING OF PADDLEFISH INDUCED BY MEANS OF PITUITARY MATERIAL. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 13-19.

Nine adult paddlefish (Polyodon spathula) were given injections of pituitary glands to induce spawning. Donor fish were carp (Cyprinus carpio) and paddlefish. Seven of the nine injected fish were induced to spawn. Two females injected with paddlefish pituitaries spawned, but two other females treated with carp material did not respond. Male fish responded to both paddlefish and carp pituitaries. The egg release was complete in one female and extended over 24 to 36 hours. Ovulation in the second female took longer. Egg fertility was low for both females. About 510 young paddlefish were produced from the first female. No fry were hatched in the laboratory from the second female, but 130 viable eggs were preserved for study and 230 viable incubating eggs were used for embryological studies. Nearly all the fry survived the first few days, but 6 days after the first hatching all but 25 were dead and these survivors died later. The loss was attributed to toxic levels of zinc and copper in the holding tank. (Auth.)

7402. Richardson, William M. (California Dept. of Fish and Game, Los Angeles). 1965. ELECTRIC ROTARY FISH SCREENS. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 20-22.

Electrically powered rotary fish screens used in three California Department of Fish and Game hatcheries are described and details of construction given. Screen sizes range from 24 to 30 inches in diameter and from 28 to 59-3/4 inches in length, and normally handle water flows ranging from 2 to 5 cfs for the small screens to 20 or more cfs for the larger screens. (Auth.)

7403. Johnson, Murray G. (Metropolitan Toronto & Region Cons. Authority, Woodbridge, Ontario, Canada). 1965. CONTROL OF AQUATIC PLANTS IN FARM PONDS IN ONTARIO. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 23-30.

A total of 112 weed problems, created mainly by submergent aquatics and filamentous algae, were treated with 14 herbicides in 20 formulations. Treatments with 1 ppm of copper sulphate generally controlled Cladophora spp. and Spirogyra spp., but two or three applications of 1 ppm, spaced 2 to 3 days apart, produced better results in some ponds. Chara was reduced by copper sulfate, but applications at rates of 2 ppm and more were required for good control. Submergent aquatic vegetation (mainly Potamogeton pectinatus, P. foliosus, and Najas flexilis) was treated with sodium arsenite, Diquat, Paraquat, Fenac, Simazine, Atrazine, 2, 4-D, Endothal and Silvex, all of which produced fair to excellent results. Silvex, Diquat, and Paraquat appeared most useful for control of Elodea canadensis. The apparent effects of several herbicides on fish and fish food organisms were examined. (Auth.)

7404. Gebhards, Stacy V. (Idaho Fish and Game Dept., Jerome). 1965. TRANSPORT OF JUVENILE TROUT IN SEALED CONTAINERS. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 31-36.

Polyethylene bottles and double plastic bags with screw caps were developed for transporting juvenile trout into mountain lakes and remote areas of Idaho. Fish ranging in size from 75 to 3,600 per pound were loaded at a density of 12 ounces of fish per one-half gallon of water with an oxygen-to-water ratio of 3:1 by volume at atmospheric pressure. Cellular plastic insulators held water temperatures below 45° F up to 12 hours. Tests with a sedative (M.S. 222) and a buffering agent (tris-buffer) to control carbon dioxide revealed no advantages for increasing loading density or survival. Accumulation of carbon dioxide in the sealed containers apparently induced narcosis and reduced toxicity of ammonia by lowering pH. Survival in transit averaged 96.0 percent with the plastic bottles and 99.9 percent with the plastic bags. Investigations in 1963 of lakes stocked during 1962 with plastic bottles showed excellent carryover and growth of the transported fish. (Auth.)

7405. Riel, Arthur D. (New Hampshire Fish & Game Dept., Concord). 1965. THE CONTROL OF AN OVERPOPULATION OF YELLOW PERCH IN BOW LAKE, STRAFFORD, NEW HAMPSHIRE. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 37-41.

Use of pound nets to reduce the adult population and rotenone to destroy the bulk of the annual egg production proved to be an efficient and economical technique for controlling an overpopulation of yellow perch (Perca flavescens) in 1,240-acre Bow Lake. Actual cost of the project was lower than the estimated costs of either total or partial reclamation. In addition, the data indicated an increase in the growth rates of smallmouth bass (Micropterus dolomieui) and yellow perch populations hatched during the years of control work. Creel census data, collected the year after cessation of control activities, indicated a significant improvement in angling for smallmouth bass. (Auth.)

7406. Conrad, John F. (Oregon Fish Comm., Clackamas). 1965. OBSERVATIONS ON "BAD EGGS" IN COLUMBIA RIVER FALL CHINOOK SALMON. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 42-44.

Large numbers of ova from Columbia River fall chinook salmon (Oncorhynchus tshawytscha)

have been discarded at some Oregon Fish Commission hatcheries during certain years because of a condition termed "bad eggs." Fish culturists believe that fingerling survival would be too small to justify the additional required handling expense. Results from studies made during two seasons at the Oxbow Hatchery indicate that about 60 percent of the eggs from bad-egg females may survive to liberation. However, the bad-egg females averaged 42 to 45 percent less obtainable eggs than the normal fish, and survival based on expected egg potential was only 32 to 36 percent. A 1:9 labor differential for normal and abnormal eggs may preclude the spawning of bad-egg females except during years of very limited egg takes. (Auth.)

7407. Eisler, Ronald, and David G. Deuel (Bur. of Sport Fish. & Wildl., Sandy Hook Marine Lab., Highlands, New Jersey). 1965. ACUTE TOXICITY OF SOAPS TO ESTUARINE FISHES. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 45-48.

Toxicity of three household soaps to mummichogs (Fundulus heteroclitus) was determined at 23 0/00 salinity and 20° C. Concentrations which killed 50 percent (LD_{50}) in 96 hours ranged from 750 ppm for soap I to 1,540 ppm for soap L. LD_{50} values (96 hours) of L for mullet (Mugil cephalus) and for silversides (Menidia menidia) were 580 and 790 ppm, respectively. Salinity of the medium affects solubility of soaps. Soaps were most soluble at salinities approaching fresh water, but formed precipitates and insoluble complexes with increasing salinity. Mummichogs exposed to a high concentration of each soap experienced heavy mortality at test salinities of 21 0/00 and lower. Few or no deaths were observed at higher salinities. (Auth.)

7408. Jones, Irving W., and Carl H. Copper (Oregon Fish Comm., Sandy). 1965. AN ACCURATE PHOTOELECTRIC EGG COUNTER USING A JET PUMP. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 52-54.

A device utilizing a jet pump and a photoelectric counter provided an accurate count of live, eyed coho salmon (Oncorhynchus kisutch) eggs as they were moved from one basket to another in a hatchery trough. Groups of 5,500 and 8,250 eggs were passed through the counter at speeds ranging from 4.6 to 8.5 fps. Maximum and minimum count rates were 1,600 and 644 eggs per minute, respectively. Accuracy was excellent. Mortality of 24,750 eggs passed through the counter was 1.4 percent, while mortality of a control group was 1.8 percent. (I. W. Jones)

7409. Meyer, Fred P. (Bur. Sport Fish. & Wildl., Stuttgart, Arkansas). 1965. A PSEUDOPARASITIC INFESTATION OF CRAYFISH. The Progressive Fish-Culturist, Vol. 27, No. 1, p. 19.

7410. Fessler, James L. (Oregon State University, Corvallis). 1965. USE OF ELASTRATOR TO FACILITATE PLUMBING OF LABORATORY APPARATUS. The Progressive Fish-Culturist, Vol. 27, No. 1, p. 22. Illus.

7411. Post, George (Bur. Sport Fish. & Wildl., Fort Collins, Colorado). 1965. A METHOD OF IMMOBILIZING FISH FOR COLLECTION OF BLOOD OR FOR INOCULATION. The Progressive Fish-Culturist, Vol. 27, No. 1, p. 48. 2 Illus.

7412. Patterson, H. R., and Kenneth R. Hutton (San Jose State College, San Jose, California). 1965. RACE-SPECIFIC ERYTHROCYTE ANTIGEN OF CHINOOK SALMON. The Progressive Fish-Culturist, Vol. 27, No. 1, p. 51.

7413. Schoenecker, William, and William Rhodes (Game, Forestation and Parks Comm., Alliance, Nebraska). 1965. POTASSIUM PERMANGANATE DISPENSER. The Progressive Fish-Culturist, Vol. 27, No. 1, pp. 55-56. 4 Illus.

7414. Klust, G., and H. Mann. 1962. DETERGENTS AND FISHERIES. Allg. FischZtg, 87, No. 3; LitBer. Wass. Abwass. Luft u. Boden, 1962/3, 11, 122; Water Pollution Abstracts, Vol. 37, No. 6, Abst. No. 1009. 1964.

After discussing the importance of modern detergents and the amounts used, the authors deal with the occurrence of these substances in fishing waters and the damage done to fish and fish food. Figures are given for the toxicity of various detergents to fish and the damage done to fish eggs. Damage to fish consists mainly in destruction of the mucous membrane, especially of the gills. Other harmful effects include retarded decomposition of cellulose and destruction of animals and lower water plants of importance for fish food.

7415. Mann, H. 1962. THE IMPORTANCE OF SYNTHETIC WASHING AGENTS (DETERGENTS) TO FISHERIES. Fischwirt, 12, 97-101; LitBer. Wass. Abwass. Luft u. Boden, 1962/63, 11, 123; Water Pollution Abstracts, Vol. 37, No. 6, Abst. No. 1010. 1964.

After a general discussion of the production, properties, and importance of synthetic detergents, the author deals with their occurrence in fishing waters and their effect on fish and fish food organisms. Experiments are described on toxicity to fish and other water animals and the results are given in tables. Increase in temperature was found to accelerate the toxic action which was also increased by oxygen deficiency. The content of lime was not of importance. By slow acclimatization fish developed a certain resistance.

7416. Mann, H. 1962. INCREASE BY DETERGENTS OF EFFECTS ON TASTE IN FISH. Fischwirt, 12, 237-240; LitBer. Wass. Abwass. Luft u. Boden, 1962/63, 11, 122; Water Pollution Abstracts, Vol. 37, No. 6, Abst. No. 1011. 1964.

After a brief summary of recent investigations into the effect of substances, such as oils and phenols, on the taste of fish, the author describes investigations with different detergents which, as

solvents, may encourage the penetration of matter into the tissues and organs of fish. Experiments with oil and phenol showed that the effect on the taste of fish flesh was definitely and considerably increased by the presence of even small quantities of detergents.

7417. Voss, W. 1963. THE INFLUENCE OF PHOSPHORUS IN DETERGENTS ON EUTROPHICATION OF LAKE CONSTANCE. Gas- u. Wasserfach, 104, 397-399; Water Pollution Abstracts, Vol. 37, No. 6, Abst. No. 1012. 1964.

The author reviews studies over a period of 8 years on the development of eutrophic conditions in Lake Constance. The concentration of phosphate in the lake is now four times as great as in 1958; 65 percent of the phosphate originates from sewage discharges and 35 percent from synthetic detergents.

7418. Kliffmüller, R. 1962. BALANCE SHEET OF THE POLLUTING AND FERTILIZING MATTER IN LAKE CONSTANCE (UPPER LAKE) IN 1958-59. Gas- u. Wasserfach, 103, 1365; Water Pollution Abstracts, Vol. 37, No. 6, Abst. No. 1013. 1964.

Investigations were made from August 1958 to August 1959 into the amounts of polluting and fertilizing substances (oxygen, phosphate, nitrogen, etc.) flowing into and out of Lake Constance and the results are shown in a chart. The problems of treatment of a eutrophic water and the importance of preventing increase of eutrophic conditions are discussed.

7419. Zahner, R. 1962. THE EFFECT OF MOTOR FUELS AND OILS ON RAINBOW TROUT. Vom Wasser, 19, 142-177; Water Pollution Abstracts, Vol. 37, No. 6, Abst. No. 1017. 1964.

A description and diagram are given of an aquarium used for experiments on the effect on rainbow trout of various types of petrol and motor oils. The results of various experiments are expressed diagrammatically and described and their application to conditions in natural waters is discussed. For ordinary petrol the lethal limit (based on a 48-hour experimental period in moving water) is given as between 100 and 260 mg per liter and for high-octane petrol, between 40 and 100 mg per liter. The type and degree of toxicity are determined by the type and amount of added substances, the fraction of easily volatile components, the composition of the petrol, and the degree of emulsification. For the various diesel, motor, and heating oils tested, the lethal concentration in the same conditions is reached at 50-500 mg per liter. The high toxicity is caused by the strong tendency to emulsification, the formation of a covering oil film, and the presence of toxic water-soluble fractions. Under the same experimental conditions, the reactions are specific for petrols of different composition but for oils they are largely the same independent of the composition. From experiments in standing water no conclusions can be drawn as to the toxicity of petrols and oils in flowing water.

7420. Klinke, H. R. 1962. EFFECTS OF OIL AND TAR PRODUCTS IN WATER ON THE FISH ORGANISM. Münch. Beitr., 9, 75-81; LitBer. Wass. Abwass. Luft u. Boden, 1962/63, 11, 194-195; Water Pollution Abstracts, Vol. 37, No. 6, Abst. No. 1018. 1964.

The author deals with the effects on fish of pollution by oils and tar products, discussing the suffocating effect of the oil film and the toxic action of phenols and cresols. The action of oil and tar products on the taste of fish and the indirect effect of destruction of fish food are discussed.

7421. Macan, T. T. 1963. FRESH-WATER ECOLOGY. Longmans, Green & Co. Ltd., London, 348 pp.; Water Pollution Abstracts, Vol. 37, No. 7, Abst. No. 1061. 1964.

This book on fresh-water ecology contains chapters on physical and chemical properties of water; fresh-water communities; the transport, behavior and inter-relationships of aquatic organisms; the effect of physical factors, such as water movement, desiccation and temperature; the effect of chemical factors, such as oxygen, salinity and calcium; organic production; and methods for studying fresh-water populations. Appended are a bibliography, index to species names, and English names of organisms, and author and subject indexes.

7422. Pye, J. D. (Dept. of Zoology, King's Coll., Strand, London, W. C. 2, England). 1964. NERVOUS CONTROL OF CHROMATOPHORES IN TELEOST FISHES. I. ELECTRICAL STIMULATION IN THE MINNOW (PHOXINUS PHOXINUS (L.)). The Journal of Experimental Biology, Vol. 41, No. 3, pp. 525-534.

Electrical threshold curves have been obtained for the stimulation by square and saw-tooth pulses of peripheral melanophore-aggregating nerve fibers in the minnow, Phoxinus. The responses show complete independence of pulse repetition rate over a wide range.

The results of von Gelei on the electrical stimulation of the spinal cord in ergotamine-treated minnows have been confirmed but it is found that the melanophore-dispersing activity may pass forward or backward from a stimulating electrode at any level of the spinal cord.

Identical results have been obtained for melanophore-aggregating activity in non-ergotized fish. All the spinal responses are slow and incomplete at repetition rates below 10/sec.

Von Gelei's arguments for mapping the pathways of melanophore-dispersing nerve fibers are shown to be insupportable. (Auth. Summ.)

7423. Pye, J. D. (Dept. of Zoology, King's Coll., Strand, London, W. C. 2, England). 1964. NERVOUS CONTROL OF CHROMATOPHORES IN TELEOST FISHES. II. THE INFLUENCE OF CERTAIN DRUGS IN THE MINNOW (PHOXINUS PHOXINUS (L.)). The Journal of Experimental Biology, Vol.

41, No. 3, pp. 535-541.

Responses of melanophores to injections of adrenaline or L-noradrenalin have been examined with and without prior injection of ergotamine.

Responses of the melanophores of isolated skin preparations in solutions containing adrenalin or L-noradrenalin have been examined with and without prior injections of, or direct exposure to, solutions of ergotamine.

No reversal of response could be found in any of the above cases.

Responses of melanophores following injections of Rogetine (an alternative adrenergic blocking agent) are quite unlike those after ergot but closely resemble those after atropine.

It is concluded that it is unjustified to assume that drugs produce similar effects in fishes and in mammals. The case for double innervation of melanophores is, therefore, still unproven. (Auth. Summ.)

7424. Pye, J. D. (Dept. of Zoology, King's Coll., Strand, London, W. C. 2, England). 1964. NERVOUS CONTROL OF CHROMATOPHORES IN TELEOST FISHES. III. LOCAL TEMPERATURE RESPONSES IN THE MINNOW (PHOXINUS PHOXINUS (L.)). The Journal of Experimental Biology, Vol. 41, No. 3, pp. 543-551.

Observations of earlier workers on the chromatic responses to local heating or cooling of the skin of Phoxinus have been confirmed. They have also been found to hold true for anaesthetized fish, in which finer control and observation are possible.

The results of a series of nerve-section experiments are held to exclude any possibility that the responses of the intact fish are mediated by a nervous reflex from thermoreceptors in the skin.

The responses of melanophores following section of the chromatic motor tracts, or when isolated from the body, are considered to be independent cellular responses.

Normal responses in the intact fish show clear temperature thresholds and are completely dependent upon continuation of the respiratory rhythm.

Possible physiological mechanisms for mediating these non-adaptive responses are discussed and a new hypothesis is put forward. (Auth. Summ.)

7425. Pye, J. D. (Dept. of Zoology, King's Coll., Strand, London, W. C. 2, England). 1964. NERVOUS CONTROL OF CHROMATOPHORES IN TELEOST FISHES. IV. A COMPARATIVE SURVEY OF LOCAL TEMPERATURE RESPONSES. The Journal of Experimental Biology, Vol. 41, No. 3, pp. 553-557.

The rate of chromatic adaptation to background color has been examined briefly in thirty-three species of teleost fishes (from nineteen families, eight orders) to test the presence of nervous control of chromatophores.

The same fishes have then been tested for chromatic responses to local heating or cooling of the skin.

Thermal responses resembling those of Phoxinus have been found in fourteen species which show quick adaptation, but not in thirteen other such species. No thermal responses have been found in any of the six species which do not show quick adaptation.

There appears to be no significance in the taxonomic distribution of these results and no new responses to temperature have been found. (Auth. Summ.)

7426. Potts, W. T. W., and Gwyneth Parry (Dept. of Zool. & Comparative Physiology, The University, Edgbaston, Birmingham, England). 1964. SODIUM AND CHLORIDE BALANCE IN THE PRAWN, PALAEMONETES VARIANS. The Journal of Experimental Biology, Vol. 41, No. 3, pp. 591-601.

The exchanges of sodium and bromide (for chloride) ions between the brackish-water prawn Palaemonetes varians and its environment are described.

In an isosmotic medium the exchange of sodium and chloride ions takes place by passive diffusion.

In full-strength sea water sodium ions are actively removed extrarenally, the potential difference produced by the active extrusion of sodium ions maintaining the chloride ions in passive equilibrium. There is some evidence of an increased flux of ions in hyperosmotic sea water associated with water-swallowing to obtain water for water balance.

In 2% sea water chloride ions are actively absorbed, the potential produced by this active uptake helping to maintain sodium balance; but some active sodium uptake also occurs.

In salinities below 2% uptake of ions declines and the animals can no longer maintain equilibrium. (Auth. Summ.)

7427. Berry, Frederick H. (U. S. Bur. Comm. Fish., Brunswick, Georgia). 1965. THE SPOTTED JACK CREVALLE, CARANX MELAMPYGUS CUVIER, IN THE EASTERN PACIFIC. Calif. Fish and Game, 51(1): 28-36.

External morphological characters and their ontogeny in the juvenile-adult stages are described for the spotted jack crevalle, Caranx melampygus. Caranx medusicola is documented as a junior synonym. (Auth.)

7428. Linn, Jack D. (California Dept. Fish and Game, Lake Tahoe), and Ted C. Frantz. 1965. INTRODUCTION OF THE OPOSSUM SHRIMP (MYSIS RELICTA LOVEN) INTO CALIFORNIA AND NEVADA. Calif. Fish and Game, 51(1): 48-51.

In 1963 and 1964, 182,300 live opossum shrimp were introduced into four lakes in California and Nevada (Lake Tahoe, Lower Echo Lake, Huntington Lake, and Blue Lake). These had been collected at Upper Waterton Lake, Canada, and Green Lake, Wisconsin. It is hoped they will become established locally, and provide forage for trout. (Authors)

7429. La Faunce, Don A. (California Dept. Fish and Game, Sacramento). 1965. LONG-TERM

RETENTION OF TAGS BY SOME FRESH-WATER FISH. Calif. Fish and Game, 51(1): 52-53.

Studies in California have demonstrated that some warm-water game fish can retain tags for considerable periods. White catfish, Ictalurus catus; brown bullheads, Ictalurus nebulosus; channel catfish, Ictalurus punctatus; and largemouth bass, Micropterus salmoides, all held staple or disk-dangler tags for periods exceeding 8 years. (J. H. R.)

7430. Menchen, Robert S. (California Dept. Fish and Game, Sacramento). 1965. AN OBSERVATION OF KING SALMON SPAWNING SUCCESSFULLY IN DEER CREEK IN MARCH 1964. Calif. Fish and Game, 51(1): 53-55.

King salmon (Oncorhynchus tshawytscha) were observed spawning in early March in Lower Deer Creek, Tehama County, California. In this Sacramento River tributary stream, high water temperatures were believed to have prevented successful spawning at this time of year. In May, a redd was sampled and healthy-looking fry were recovered, indicating that in spite of high surface water temperatures during the period between egg deposition and swim-up, some king salmon production can be expected from early March spawning in Deer Creek. (Auth.)

7431. Phillips, Julius B. (California Dept. Fish and Game, Pacific Grove). 1965. NORTHERN RANGE EXTENSION FOR THE ZEBRAPERCH, HERMOSILLA AZUREA JENKINS AND EVERMANN. Calif. Fish and Game, 51(1): 55-56.

About 40 zebraperch caught in July 1964 extend its range 275 miles northward to Monterey, California. (Auth.)

7432. Schott, Jack W. (California Dept. Fish and Game, Terminal Island). 1965. A VISUAL AID FOR AGE DETERMINATION OF IMMERSED OTOLITHS. Calif. Fish and Game, 51(1): 56.

Black glass is used for improving ring contrast in age determination studies of immersed otoliths. (Auth.)

7433. Isaacson, Peter A. (U. S. Publ. Health Serv., Dauphin Isl., Alabama), and Richard L. Poole. 1965. THE THREADFIN SHAD, DOROSOMA PETENENSE, IN NORTHERN CALIFORNIA OCEAN WATERS. Calif. Fish and Game, 51(1): 56-57.

Further evidence of the invasion of ocean waters by the threadfin shad is noted. A single specimen was taken at Drakes Bay some 54 miles from Carquinez Straits, the only known area of occurrence in this region. (Authors)

7434. Isaacson, Peter A. (U. S. Publ. Health Serv., Dauphin Isl., Alabama), and Richard L. Poole. 1965. NEW NORTHERN RECORDS FOR THE SPOTFIN SURFPERCH, HYPERPROSOPON ANALE. Calif. Fish and Game, 51(1): 57.

The range of the spotfin perch is extended from San Francisco to the Russian River, a distance of about 51 miles. Evidence indicates a sizable population exists in this area. (Authors)

7435. Isaacson, Peter A. (U. S. Publ. Health Serv., Dauphin Isl., Alabama). 1965. SOUTHERN RANGE EXTENSION OF THE TOMCOD, MICROGADUS PROXIMUS. Calif. Fish and Game, 51(1): 58.

Four tomcod were taken WNW of Point Sal in 117-120 fathoms during 1961. These four specimens extend the tomcod's range 135 miles to the south. (Auth.)

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